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Precipitators and Recarbonation Chambers at Minneapolis Water Works (*See article, page 605*)

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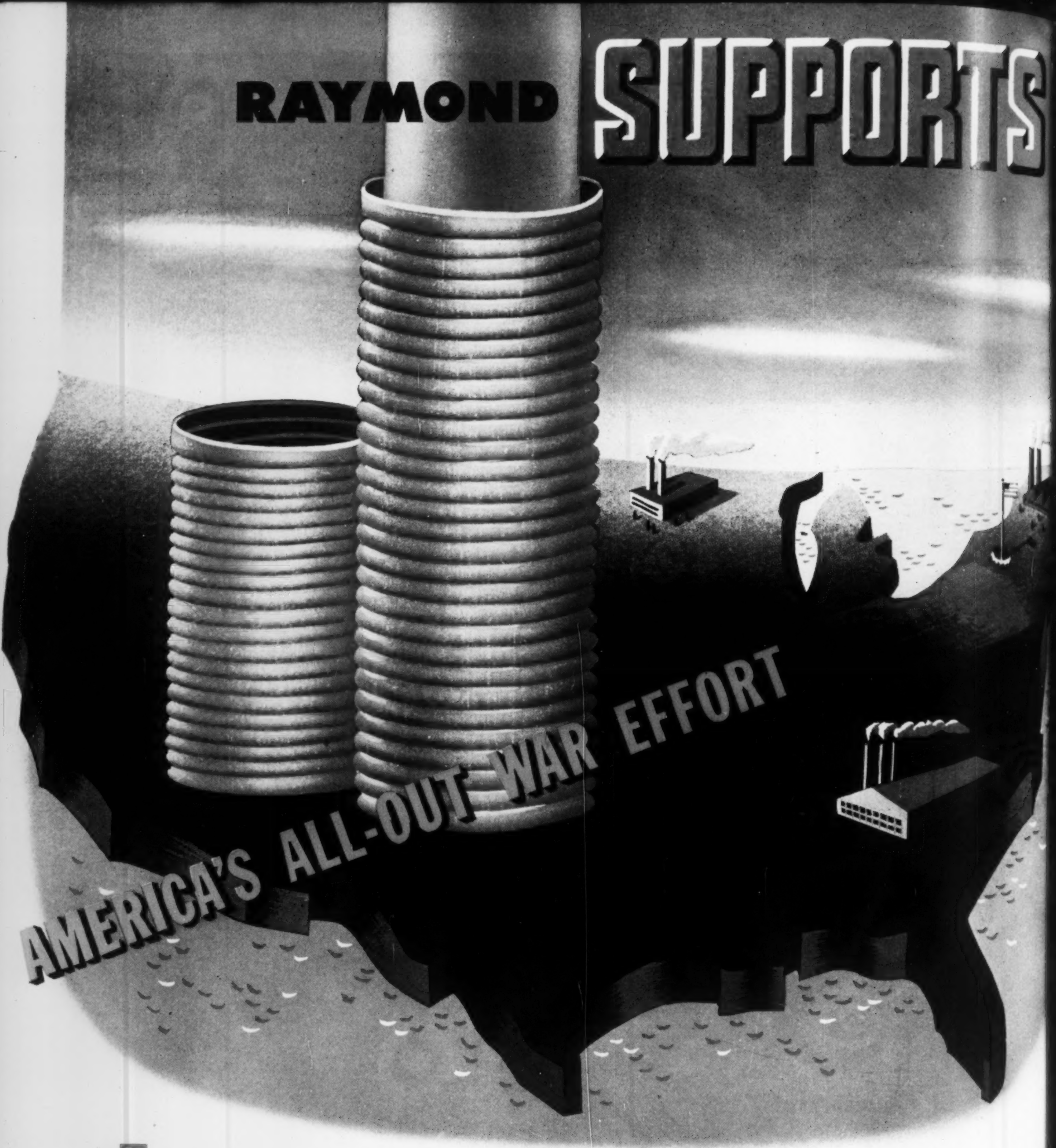

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Something to Think About

A Series of Reflective Comments Sponsored by the Committee on Publications

What's Wrong with Sanitary Engineering?

By GEORGE E. SYMONS, ASSOC. M. AM. SOC. C.E.

CHIEF CHEMIST, BUFFALO SEWER AUTHORITY, BUFFALO, N.Y.

WHAT'S wrong with sanitary engineering? To ask this question is to infer that the profession of sanitary engineering has not reached a place of distinction in the arts and sciences. That the question has been asked is indicated by the existence of a Committee for the Advancement of Sanitary Engineering, in the Sanitary Engineering Division of the Society. A report of this committee was rendered in January, and appeared in PROCEEDINGS for June 1942.

Answers to the Question.~To paraphrase the question—Why has not the science of sanitation reached a place of distinction? One of the following may be the answer:

Youth is the first reason. Sanitary engineering, as a science, is too young to have reached desired professional acclaim. We cannot, like students of medicine, take the oath of a Hippocrates or point to the sanitary engineering of a patron founder as one can to the bacteriology of a Koch or a Pasteur, or the chemistry of a Lavoisier or a Scheele.

Diversity of the component sciences is a second reason. Sanitary engineering emerged from the demand for health protection before the basic sciences involved in water purification and sewage treatment were known or understood. The result has been that sanitary engineering has been unable to absorb the many allied sciences bound to it, such as chemistry, bacteriology, limnology, and hydraulics.

Sanitary Engineering Not Defined.~Lack of agreement on a name for the profession is a third reason. Sanitary engineering has not fully defined itself. The Society Committee states that "the terms sanitary and sanitation are etymologically all-inclusive and there would therefore seem to be no linguistic reason why the designation 'sanitary engineer' should not imply one who is interested in every phase of the control of the human environment in so far as the engineer and engineering are concerned therewith." There are many persons, however, in governmental public health departments who favor the term "public health engineer."

In accordance with the membership requirements in the Society for men who are not educated as civil engineers, but whose interests and experience make them eligible for Society membership, the committee has recognized that the profession should be open to chemists, bacteriologists, biologists, or chemical engineers.

Criticizing Educational Curricula.~Lack of uniformity of education is a fourth reason. As to the theory of teaching, the committee's report stated that there exists "such a lack of uniformity of curricula as to indicate the impracticability" of suggesting a generally applicable schedule. The report suggested that the undergraduate course must be extended beyond four years; or for the necessary sanitary engineering training we must look to one or more years of postgraduate study. Prof. Gordon M. Fair, of Harvard University, favors graduate instruction in a few institutions, inasmuch as consulting engineers and governmental agencies have been satisfied with graduate civil engineers who have had optional courses in water supply and sewage disposal.

Somewhat opposed to graduate study after a conventional civil engineering course is Prof. Thomas R. Camp, of Massachusetts Institute of Technology, who has presented the idea that the undergraduate training of sanitary engineers should include more time and study of basic chemistry and biology than are offered in the conventional civil engineering curriculum. In short, a special four-year course in sanitary engineering is better, not only for four-year graduates, but also for those who desire post-graduate study in sanitary engineering.

No Popular Appeal.~Lack of popular and esthetic appeal is a fifth reason. Sanitary engineering deals with a problem that has either been ignored in the public mind through a lack of knowledge or has been considered taboo as a subject for conversation in polite society. The lay public is apt to feel that inasmuch as water falls from the heavens, it should be free, and that no great problem is involved in getting it into the household sink. And sewage is classed with the risqué story, or humor of the Chic Sale variety.

Indifference of the public to the type of operator chosen for water and sewage plants is a sixth reason. This is evidenced by the fact that local politics often prevail in such appointments. The profession has not insisted that only thoroughly trained men be appointed to these important positions.

Finally, lack of unity within the profession is a seventh reason. This is indicated in the criticism that designers receive even from trained operators. It also indicates a weak spot in that sanitary engineers may not be sufficiently acquainted with the relation between design and operating problems.

A Divergence of Views.~That the profession of sanitary engineering has not defined itself was amply evident at the Conference on Sanitary Engineering of the Society for the Promotion of Engineering Education, held at Ann Arbor in 1941. After the presentation of papers by Arthur B. Morrill, Prof. H. E. Babbitt, and George E. Symons (all members, Am. Soc. C.E.), I made the following notes on the discussion that ensued.

Civil engineers, for the most part, both professionally and professorially are unwilling to admit that sanitary engineering is any more than a minor option in civil engineering.

Engineers engaged in the operation of sanitary works and professors who have had close contact with operation and its requirements see a distinct need—not for specialization in preference to fundamentals, but for fundamentals in the many varied sciences of which sanitary engineering is composed. It is my contention that the very fact that sanitary engineering is the on'y so-called option in civil engineering which needs allied sciences, shows that it is not a mere "branch."

It appears that design and construction are not all-important today. This is because design must consider that chemical and bacteriological unit processes (as in chemical engineering) are to take place, and the administration and operation of these biochemical processes must consider the sociological aspects of the effects on public health.

Confused Title.~The title for this science is even more confused than the committee report indicated. Prof. H. E. Babbitt piles the term "public health engineering" on top of "sanitary engineering," places the whole in civil engineering, and indicates that because of the opprobrium attached to the term "sanitary" by the lay public, perhaps the other title would be more appropriate. Prof. G. H. Dunstan differentiates between the two terms, and indicates that the "public health engineer" is more qualified in health fields, and that "public health engineering" is broader and includes "sanitary engineering."

There is no disagreement that all engineers need adequate instruction in English in order to improve their ability to speak and to write. Likewise, there appears to be agreement that the sanitary engineer needs more chemistry and biology. As for the practical aspects of teaching sanitary engineering, a number of suggestions were made. These included the addition of shop courses in plant operation, the practicability of a five-year curriculum, apprenticeship for graduates, and the need for a return to fundamentals and away from specialization.

A Profession, or Not?~From this welter of opinion, what can we decide? Either we are a profession and should have professional training and standing in our own right, or we are nothing. A hodgepodge of civil engineers (with insufficient knowledge and training in the several sciences indigent to the field of sanitation), of chemists, bacteriologists, biologists, mechanical engineers, chemical engineers and others, is not a profession.

If there is no reason to establish a professional solidarity, then there is no reason to discuss either a four-year or a five-year curriculum in sanitary engineering. One may as well admit that a two-week short school is sufficient for operators of water and sewage plants. At most, ninety days would be needed to give civil engineers two or three special courses, thereby producing competent operators or engineers for public health staffs.

For Future Action.~On the other hand, if there is an expanding future both in the operation of sanitary works and on public health staffs, then it is time for some courageous thinking and planning. I am emboldened to make the following suggestions.

1. Establish the term "sanitary engineering" and "sanitary engineer" as all-inclusive, and thereby establish a profession as such. "Sanitary chemistry," "sanitary biology" may be retained to indicate courses referring to water and sewage treatment and analysis, or dropped in favor of "water and sewage chemistry and biology" and "water purification," "sewerage," and "sewage disposal."

2. If the suggested title is established, it should be used in all educational institutions, and adopted by all professional groups now having sections devoted to this field. Further, full consideration, free from petty attitudes and emotional provincialism, should be given to the establishment of a symposium to correlate the groups or sections of sanitary engineers now existing in several professional societies.

3. Inasmuch as the field is not broad enough to absorb a large number of men each year, it is ridiculous for every engineering college to have a four-year course in sanitary engineering. Instead, six or eight schools with advantageous geographic distribution should set up quite similar curricula. While discontinuing graduate work, other schools may, if desired, continue to offer elective survey courses in water purification, sewerage, sewage disposal, and water and sewage analysis for the benefit of civil engineers, chemists, bacteriologists, and chemical engineers who may be interested in the subject, or who may desire some preparation for advanced study in sanitary engineering at one of the universities offering the complete curriculum.

Raise Status of Profession.~4. Raise both the status of the profession and the standard of the graduates by establishing in these six or eight chosen schools, a five-year curriculum leading to a degree in sanitary engineering and grant a professional degree, M.S. or Ph.D. in Sanitary Engineering, for additional graduate study. Graduate and post-graduate engineers from such a curriculum would have a professional status equal to that of members of the medical profession rather than subservient to it. Students from engineering schools not offering the five-year course might transfer at the end of the third year to a school offering the complete course.

5. The professors of sanitary engineering must take the initiative in considering the future of this profession. By means of a committee of interested persons, both in and out of the teaching profession, the future of the profession of sanitary engineering must be formulated. Otherwise, all concerned must be content to allow the profession either to disintegrate or to remain a rather dubious breed with an uncertain parentage and an uncertain future.

Is this controversy an evidence of the competitive spirit that naturally exists between professions, professors, and educational institutions? Is it an expression of the emotional provincialism to which we humans cling? Or rather, is it not the outward sign of an inner struggle which marks the formation of a great science?

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Protection of Electric Power Facilities

Kilowatt Hours Engage the Enemy on the Home Front

By Thomas R. Tate
Director, National Defense Power Staff, Washington, D.C.

Success in the drive for ever increased war production depends upon a constant and dependable supply of electric power. Essential to the maintenance of this service and others is carefully planned protection against hostile acts of those aiding the enemy. Mr. Tate presents this description of protective measures undertaken long before Pearl Harbor with the hope that the methods and organization outlined may guide all who must assume responsibility for maintaining both civilian and industrial activities. This paper is a revision for general publication of the confidential paper presented by Mr. Tate in the Symposium on Civilian Protection in Wartime, at the Society's Roanoke Meeting.

The importance of electric power in the war effort cannot be overemphasized. In the words of Chairman Leland Olds of the Federal Power Commission to the Midwest Power Conference at Chicago, April 9, 1942, "You can't fight a war without men. And men can't fight a war without kilowatt hours, billions of kilowatt hours. The men at the front are almost literally fighting the enemy with kilowatt hours—kilowatt hours embodied in planes and ships and tanks and guns and high explosives. In the long run, the nations which can muster the most kilowatt hours should win the victory." It should be realized, therefore, that power supply is vital to our war effort and our national welfare. Protection of our power supply facilities, therefore, becomes of major importance. Likewise prompt and prudent action is necessary for similar facilities such as water supply systems, sewage disposal systems, transportation systems, and other utilities vital to both civilian and industrial activities.

The scope of a protection program can, perhaps, be best visualized by considering the whole problem of protection as being divided into the following three phases:

1. The protection of property against accidental damage.
2. The protection of property against intentional damage or sabotage.
3. The protection of property against actual attack by military forces of the enemy.

THREE TYPES OF PROTECTION EXPLAINED

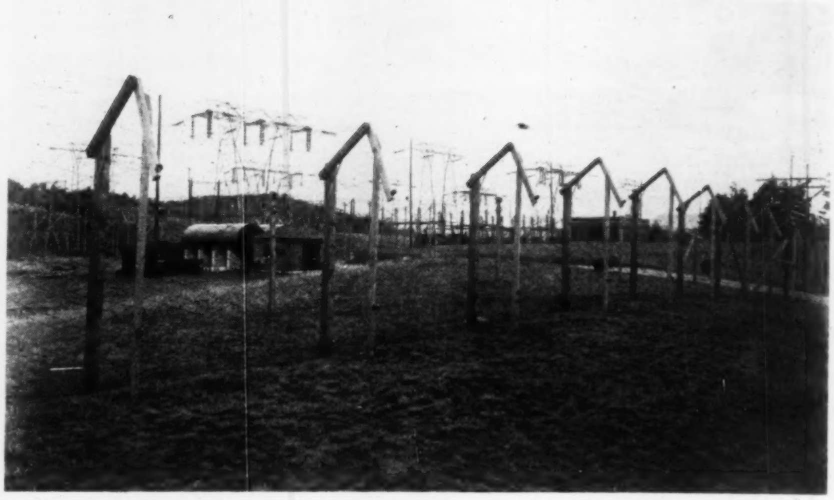
The first phase, that of protection against accidental damage, applies to normal peacetime conditions. I think I can safely say that, in general, the electric utility industry has, for many years, displayed an aggressive leadership in developing measures designed to afford the sort of protection required by these conditions. Constant improvement in the design of boilers, turbines, gener-

Protection Facilities Include Guarded Entrances Where Both Trucks and Pedestrians Must Show Credentials

Fence-Line Lighting Facilitates Guarding

ators, transformers and switch gear, and transmission and distribution facilities has increased their reliability and lessened the probability of failure from those causes which are inherent in the operation of an electric system. Developments in the field of relays and supervisory control have made it possible to limit the damage from such failures as do occur.

In cooperation with the underwriters, approved standards of fire protection have generally been complied with. The accepted practices of safety engineering have generally been followed in providing fencing and other safety devices for the protection of the employees and the public. Bear in mind, however, that for the most part, these peacetime measures have been directed against the accidental happenings which might threaten the high standards of service expected from an electric utility.



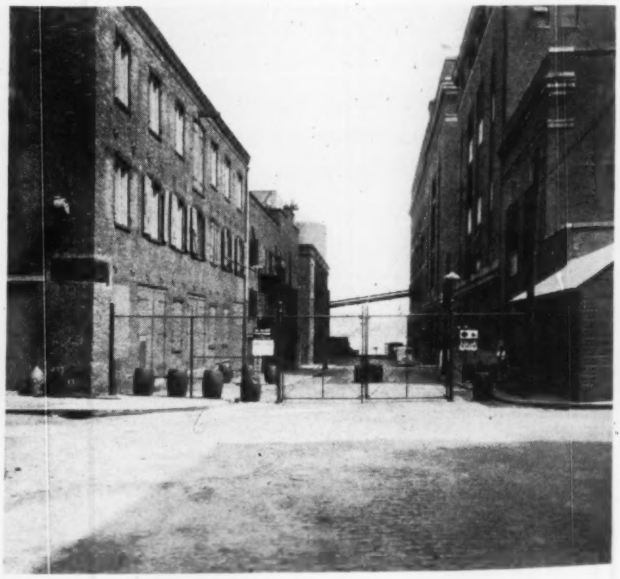
Military-Type Fence Developed by a Utility in Cooperation with the Army

The second phase, that of protection against intentional damage or sabotage, applies to conditions as they prevailed at the time the President directed the Federal Power Commission to undertake its protection program (June 14, 1940). The possibility that vital equipment may be purposefully damaged by one who is intent on disrupting the power supply for vital war industries and military and naval establishments requires that normal peacetime protection measures be reexamined from an entirely different point of view. For example, fences and other means of preventing trespass in normal times are designed, in general, to prevent the public from inadvertently entering on premises where, because of ignorance of the hazards involved, life will be endangered. With the threat of sabotage, these deterrents to trespass have a different function to perform: they must circumvent the saboteur who, far from inadvertently, is attempting to gain access to the premises by cunning and stealth.

The third phase, that of protection against actual attack by military forces of the enemy, is unfortunately the one in which we now find ourselves. Since the actual entry of our country into the war, it has become necessary to anticipate that air attacks will be made on the continental United States in an effort to disrupt industrial production and weaken civilian morale. The prevention of widespread destruction caused by high explosive and incendiary bombs dropped from the air requires far more stringent protective measures on the part of electric utilities in certain critical areas than were considered necessary while sabotage was the principal threat.

PROTECTING ELECTRIC UTILITY PROPERTY

The first consideration in working out plans for the protection of electric utility property or, in fact any other



Concrete-Filled Oil Drums Prevent Crash Entrance Through Gates property of like character, should be a determination of the most vital and most vulnerable points in the system. These could very well be classified in accordance with their order of priority. Obviously the most vital points should receive the greatest degree of protection. These would be the generating stations in the order of their size and location with respect to the importance of the load they serve; the principal substations and receiving stations; and the important feeders and important customer substations.

Measures used to protect generating stations and substations will vary in degree, in keeping with their relative importance and the nature of the system of which they are a part, or the neighboring system or systems with which they may be interconnected. Such measures will also depend on whether the stations are attended by operators at all times. Among the protective measures, those of greatest significance are:

1. Prevention of unauthorized entry of goods or persons.
2. Illumination, obscuration, and camouflage.
3. Damage from rifle fire, hand grenades, or shell fragments.
4. Damage from high explosive bombs.
5. Damage from fire and incendiary bombs.
6. Communication systems.
7. Protection of personnel.

Every vitally important property to be protected should be fenced in and guarded by armed guards, not only stationed in guard houses but actually patrolling the area constantly. A relay alarm system connected to the fence will give immediate notification of anyone attempting to scale it. Personnel working in the plant should be identified by suitable photographic cards or buttons. Strangers or visitors should be restricted to those on official business and then admitted only after proper identification. Parked vehicles should not be permitted on the property unless segregated and at a remote distance from vital works. Unattended substations and their enclosures should be locked at all times, the number of keys restricted, and the locks changed frequently. Separate space should be provided at a remote distance for the receipt and opening of goods delivered to the property. Extra precautions should be taken while carrying on any construction activities and maintaining operations. The fingerprinting of all employees engaged in operations and of guards is advisable.

On Duty at a Generating Station

ILLUMINATION, OBSCURATION, AND CAMOUFLAGE

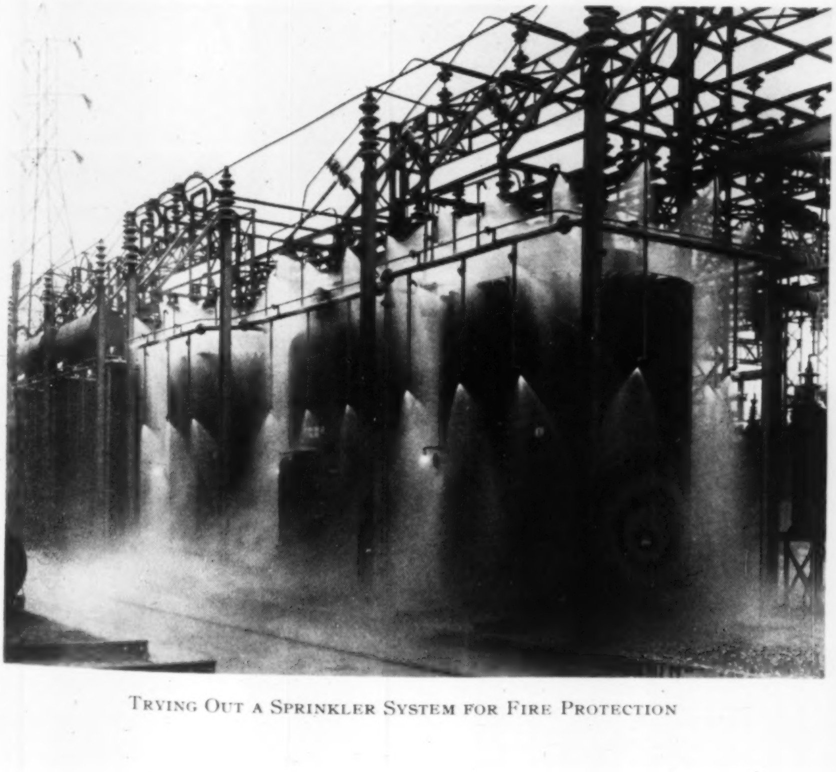
Flood lights should be so arranged as to illumine the approaches to the property and the area lying outside the enclosure. Necessary yard lighting should be dimmed and all lights arranged for control from a central point or switch. Interior illumination should be arranged for possible blackouts and emergency lighting circuits provided, or arrangements made to handle operations with approved blackout-type flashlights or portable lighting outfits. Blackout provisions for all windows, skylights, doors, and other openings where light is emitted should be enforced.

Views and authorities differ as to the value and type of camouflage. This subject is one that had better be left to an expert, but many obvious suggestions could be made as to types of paint and colors which should not be used.

Transformers and other vital equipment containing oil should be protected against loss of oil by low oil level alarms and high-temperature alarms or indicators, if attended. Temporary or semi-permanent barriers should also be erected to protect against hand grenades and shell fragments.

Existing structures and equipment cannot be protected against direct hits of high-explosive bombs, but can be protected against near misses, falling roofs, falling walls, missiles, and shell fragments.

Bomb-proof shelters for the operating personnel are considered desirable in some instances but dispersion of the operating force in various parts



Trying Out a Sprinkler System for Fire Protection

FIRE TRUCK OF MODERN TYPE

of the buildings is likely to prove most satisfactory from an operating standpoint, for fire protection, restoration of service, and first aid to the injured.

Adequate fire-fighting equipment both within and without the structures is necessary, with separate sources of water supply. Not much aid can be expected from the local fire departments in case of air raids.

Several types of communication systems are available to electric utilities—private telephone systems, leased wires, carrier current, wireless, and short-wave radio. Public address systems have found favor in some plants for direct communication between key operating men and control stations. Two or more separate communication systems should be provided for emergencies. Provision should be made for messengers (runners) if all systems fail.

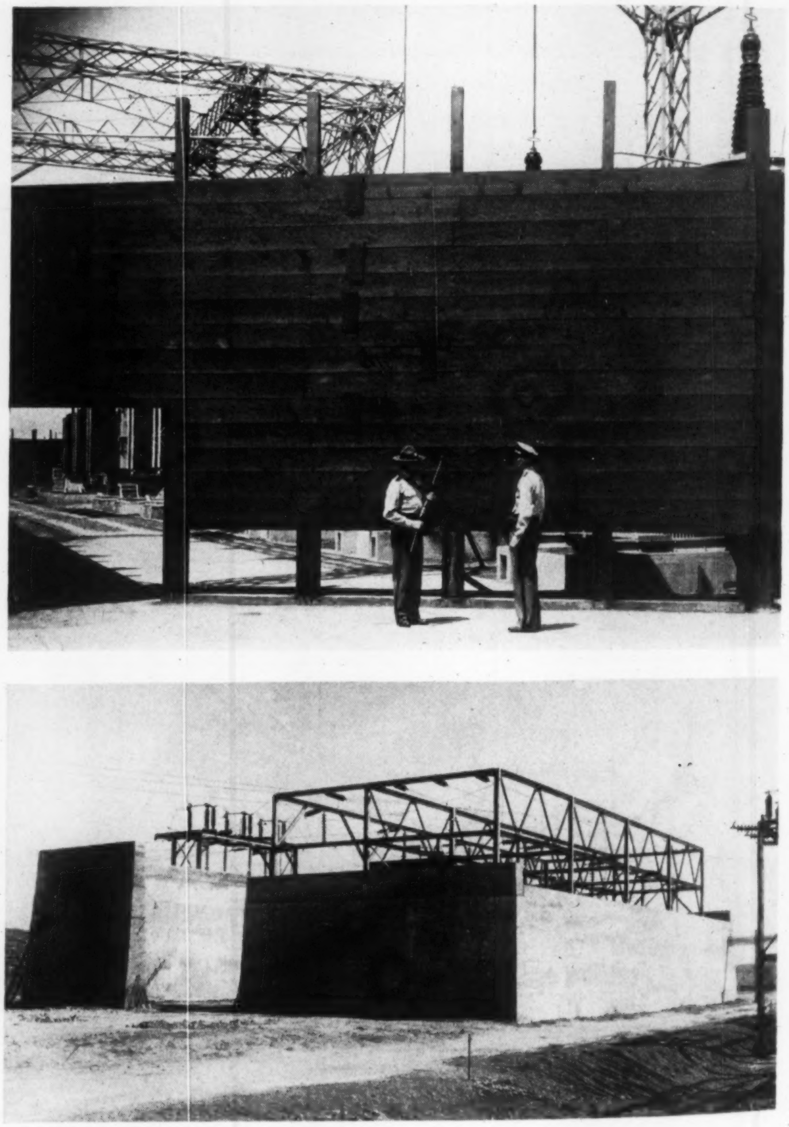
Mention has been made of bomb-proof shelters and dispersion of personnel. Of greater importance is the training of the personnel for action in emergencies, fire-fighting, first aid, and steps to restore service.

It is difficult to reduce protection matters to a rigid set of standards. In the last analysis the decision to adopt or accept a given set of protective measures as satisfactory depends, to a great extent, on the common sense, judgment, and intelligence of the individual who makes the evaluation of the situation.

It is important, therefore, that anyone engaged in a protection program have a clear conception of its objective and limitations and an understanding of the hazards it must be designed to meet. If the protection proposals of the Federal Power Commission can be said to have encountered any resistance on the part of utility management, I think it has been largely due to the difficulty experienced by the utility officials in adapting themselves to the point of view of protection against purposeful rather than accidental damage. And if, in some cases, the Commission's recommendations have appeared impracticable or unnecessary, it is probably because of failure to fully appreciate the objective of the program.

It would be physically impossible to take precautions which would guarantee absolute protection against sabotage or hostile acts even if such precautions could be justified on an economic basis. One common misconception with regard to the electric utility protection program is that it is designed to provide absolute continuity of electric service despite the efforts of the saboteur or aerial bomber. Except in certain instances, such as in the service to electrochemical industries where interruptions result in great loss in production, this is not the case. Brief interruptions to service as a result of intentional damage will have to be accepted as one of the fortunes of the war, and aside from incidental delays in production will result in no serious harm. What the protection program must do is to prevent the destruction of large and vital pieces of machinery and equipment which cannot be quickly replaced under present-day conditions.

With this thought in mind, it is obviously inadvisable to waste money, materials, and men in attempting to protect those elements of a system which can be easily replaced. It is far better judgment to ask the question, "What would I do to repair or replace this piece of equipment if it were destroyed or damaged by an enemy saboteur or as the result of an air raid, and how long would it take me to do it?" and then to take every possible precaution to protect the most vital and important parts of the system against such possible action. This will make the protection program what it is intended to be, a conservation program to prevent the loss of irreplaceable power facilities.



TYPES OF BARRIERS FOR TRANSFORMERS

The Civil Engineer and Industrial Relations

Individual Consideration of Each Case Characterizes Procedure of U.S. Conciliation Service

By John R. Steelman
Director, U.S. Conciliation Service, Washington, D.C.

Harmonious human relations are so important to the successful completion of any one of the country's war tasks that every effort must be given to securing understanding between employment groups. Courage and faith are the armor worn by the men who today are doing all in their power to bring about the cooperation of the nation's workmen. Mr. Steelman's office is carrying on this task of "human engineering" so that the necessary singleness of purpose may be achieved.

It is commonly held that the engineer with his consideration for blueprints, specifications, and job requirements has no time for the human elements that go into the final solution of his problems. Nothing could be wider from the mark. Obviously the engineer is interested in machines; he is equally interested in those who handle them. Without the contributions of labor in men and machines, blueprints and specifications would remain mere pipe dreams. And no one so practical as an engineer would argue this for a moment. Unfortunately, however, there has never been a careful appraisal of the part that harmonious human relations play in the total scheme of engineering achievements.

"It can be done. All things are possible to men of courage and faith." So spoke Henry J. Kaiser, the nation's most rapid builder of ships, whose pledge to build great air cargo carriers has rolled up a wave of popular acclaim. That is the spirit of the U.S. Conciliation Service—courage and faith. These fundamental virtues are required of labor and industry if we are to maintain full production and meet our constantly developing schedules.

A new physical world, of new materials based on new construction methods, is being born out of the tragic infernos of this war. This new world will profit greatly by the lessons we are now learning in the field of industrial, engineering, and chemical science now pressed to unprecedented limits by war's demands. Industrialists, economists, and designers are aware of these elements of change and are actively preparing for the period of activity that lies ahead. New methods, new materials, new problems, new social and economic requirements will produce not only a new era but also a new physical world. It will also produce a new society. And it is not believable that engineering intelligence will face these facts without giving due consideration both to the human and to the physical factors concerned.

The replanning of townships; the rearrangement of urban areas; the erection of countless buildings of every kind; the renovation, alteration, and reequipment of outmoded or overage structures; the conversion of industrial plants from production for war to production for peace; and the housing of the population which will change the mode and place of residence will require our best engineering intelligence. The contribution of harmonious relations between management and labor in these manifold activities cannot, will not, be ignored.

WPB News Bureau, N.Y.C.

Young and Old Join in Construction of Necessary Access Road

Specifically the engineer, as an employer of labor, a co-worker, a man who deals with payrolls, has a close day-to-day contact with all sorts of human problems. He is so constantly in the midst of them that he does not always take time to reflect on the environment and climate they provide for him. These human problems, differences of opinion, agreements, contracts, sources of new strength, potentials of dismal failures, constantly beset the engineer. Perhaps it is a tribute to his faith and courage that he has not become analytical along these lines. Nevertheless a measure of thoughtfulness, direct and unafraid, cannot hurt him as he moves on to higher levels of achievement.

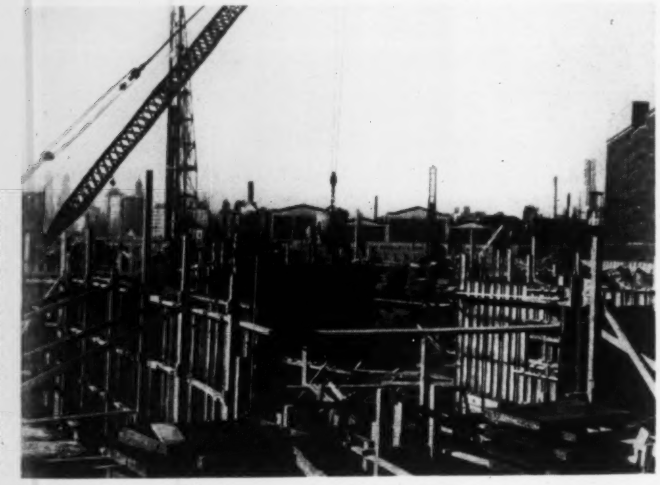
Planning for structural advances, the engineer will plan for a maximum of agreement between those who work and those who direct work. He will desire these ideal conditions and if they are lacking he will welcome the aid of those who have made it their first obligation to clear away trouble and introduce new measures of cooperation and understanding. That is the work of our Commissioners of Conciliation. We have a job of human engineering to do.

MIND AND HAND COORDINATED

The engineer is at the very heart of sound human relations. Every pleasing prospect of structural triumph is predicated on the willing hands and the keen intelligence of men who work and men who manage. Without them there would be no engineering worth the name. All about the engineer are opportunities to give suggestions of harmony and cooperation. The most successful men in this field are those who are closely identified in thought and deed with men and management. These men have their thinking solidly based on fair ideals of management and honest participation of labor in the common goal to which they have set themselves.

The highest symbol of engineering achievement and human integrity is a bridge. Mankind has been building bridges ever since the dawn of civilization and never more than today. Whether they be elementary pontoons, suspension cables, or solid masonry, these structures enable us to go straight on our way, avoid dangerous and tedious detours, and keep steadfastly to our course. That bridge of ours, that marvel of engineering skill, is what we need in the field of human relations—something that will lift us safely above the storms and stress of life onto a road of lasting fellowship and enduring human values.

Commissioners of the U.S. Conciliation Service are designers of harmony. They seek constantly to build and maintain harmonious relations between men and management in order that the production traffic of the nation may move rapidly and efficiently.



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HOUSES FOR NEWLY RECRUITED WORKMEN AT A WAR INDUSTRY RISE ON THEIR FOUNDATIONS

The present war situation presents many new problems to the Conciliation Service, but the job of settling labor-management disputes by voluntary methods of conciliation and arbitration is not new to it. The Conciliation Service has been in existence ever since the formation of the Department of Labor through an Act of Congress in 1913. During all these years the work has been carried on quietly and with no attempt to publicize. The work has been allowed to speak for itself and the amount of work to be done has always exceeded the number of men to do the job. As a result, there are many industrial establishments in the country which are not fully informed of its voluntary methods of operation.

Any representative of labor, management, or the public can request the services of a Commissioner of Conciliation by wiring the Washington Office. Within 24 hours one of the 250 train-hopping federal troubleshooters will be available to assist representatives of labor and management in arriving at some settlement agreeable to both sides. Conciliators, however, have no police power and in no instance do they force the parties to accept suggestions.

There are no blueprints for the settlement of labor-management disputes through conciliation. The types of disputes are legion and the combination of personalities appearing at the conference table daily presents different pictures. To meet these situations, Commissioners must be resourceful, alert, understanding, and persistent. Frequently deadlocks are caused by conflicting personalities. In order to establish harmony and continue negotiations, it is necessary to inject into the conference some new personality in an attempt to touch off the spark of cooperation. That ordinarily can best be done by an impartial representative who has no stakes in the proposed settlement.

The Service naturally is not responsible for the industrial situations into which it is called. It has not been party to the disputes or the economic conflicts to which it is summoned and has nothing to gain from particular provisions of settlements. This, however, is not always fairly considered. At times management, which has something to give in terms of wages and working conditions, is inclined to view any settlement as a loss and anyone connected with the settlement as an agent of the forces causing the loss. It is not like this, and the Service must always be reminding both management and labor that it is not in the business of taking something from one group and giving it to another. The business of Conciliators is to harmonize differences, prevent work stoppages, and promote production. Experience has shown that if conciliation is successful, the gain to both labor and management is incomparably greater than any loss which management may feel it has temporarily sustained.

Since the war, the number of cases handled by the Service has increased rapidly. This is due mainly to increased cooperation of labor and management. The Service has been able to handle this load by an enlarged staff and by various new and concentrated conciliation techniques. These include panel conciliation, voluntary arbitration, technical studies, and certification of cases to the National War Labor Board.

PROCEDURE FOR NEGOTIATIONS

The procedure for certifying cases, or officially referring cases, to the War Labor Board was established by an Executive Order of January 12, 1942. In this order, the President pointed out that continuous production was necessary to the war effort and that labor and management engaged in work affecting the war effort should use all established facilities to settle their disputes. The order states that the parties should first use direct negotiations; if the case is not settled in this way, the Conciliation Service should be notified in order that it may send in a Conciliator; if the case is still not settled, it can then be referred to the supreme court of industrial relations in wartime, the War Labor Board. Since January 12, the Conciliation Service has settled almost 7,000 labor disputes. It was necessary to certify less than 600 of these cases to the War Labor Board for further action.

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WORKMEN CARRY FORWARD THE RECONSTRUCTION OF AN ESSENTIAL STRUCTURE

The varying techniques of conciliation are applied to each individual case according to need. Conciliators are constantly challenged to build bridges of harmonious relations between those who differ. This work is never fully completed. Differences of opinion constantly arise among even the most fair-minded of men. And as long as these economic differences arise, it is necessary that they be met as directly and effectively as possible. The Conciliation Service is geared to the solution of these problems.

Wartime Road Problems

Digest of Talk Before Society Meeting at Roanoke, Va.

By Roy W. Crum, M Am. Soc. C.E.

Director, Highway Research Board, National Research Council, Washington, D.C.

Getting organized to win the war is turning out to be a very complicated matter. We have found that the civilian population has grave responsibilities—we are adjured to save waste paper, collect tin cans, eat less sugar for victory. But these things will not of themselves win the war. Even building roads will not insure victory. Only the fighting forces can whip the enemy for us, and it is well to keep that fact in mind. But civilian failure could lose the war—and we must remember that also. The whole population must bend every effort to putting the Army and Navy in a position to do their job expeditiously and completely.

That transportation of all kinds is a vital factor needs no argument. Men and goods must move, and this movement must not be hampered by inadequate facilities. To ensure this is the highway engineer's responsibility. Highway transportation has an important place in the service of supply, but we will understand its function better if we remember that it is a means to an end and not an end in itself.

There is another side to the picture, secondary at the moment but one that farseeing people will not lose sight of. When everything is done that can be done to get on with the war, there will still be vast numbers of people who must continue to pass their lives in civilian pursuits or else we cannot support the maximum war production, which we must have. When the war is over, if the victory is to be real, we must have preserved our civilization. We must have made plans to transfer our major efforts from the objectives of war to the objectives of peace.

To be specific, the highways of the nation are an important link in the transportation system needed for the war. Our highway responsibilities are therefore two: first, wartime traffic must be kept moving, and, second, the roads we now have must be carried through the war period in as good condition as possible. The first responsibility will entail some new construction where facilities do not exist or where they are inadequate, as well as many difficult maintenance operations. The second responsibility will entail conservation of what we have, by exceedingly careful use of available funds. And this large order must be carried out within the limitations on time, money, labor, equipment, and critical materials imposed by the exigencies of the situation.

Public Roads Administration

Rubber to Win the War—Scrap Pile of 200,000 Lb Collected in Virginia

Public Roads Administration

This Road Had to Be Widened from Two to Four Lanes, Divided, to Meet the Demands of Traffic

On construction needed to keep essential traffic moving, delays cannot be permitted. We must build as best we know how, without waiting for studies to develop the best and most economical methods. Whereas in the past emphasis has been upon building better roads more economically, now we must think in terms of getting serviceable jobs done quickly.

Road money will become more and more scarce. For jobs directly linked to the efficiency of the war effort, the necessary money will be provided in some way. For other jobs and for upkeep we must make out on whatever is available.

FINANCIAL LIMITATIONS

To the best of its ability each highway administrative unit must estimate its probable resources during the war period and plan wisely to handle its responsibilities for construction and maintenance. Some estimates that have already been reported indicate what may be expected.

For example, Charles Gordon, Managing Director of the American Transit Association, has estimated a decrease in automobile registration for 1943 of 9 to 17% below the present level. The State Road Commissioner of West Virginia, Ernest L. Bailey, sees a more gloomy picture. He estimates that by July of 1943 probably only 21% of the West Virginia passenger automobiles will be left in operation, and that the state's highway revenues will decrease from $19,000,000 in 1941 to about $13,000,000 for the current year (1942), or 32.5%. He feels that this is conservative as it assumes that commercial vehicles will continue in operation. This estimate is based on definite figures collected by the Highway Planning Survey relating to road use and number and location of year model cars in West Virginia and from a survey of tire conditions.

For North Carolina, James S. Burch and Boris B. Petroff estimate that road revenues will decline from $40,961,000 in 1941 to $30,495,000 in 1942 (a 25.6% decrease) to $15,830,000 in 1943 (a decrease of 61.4% from 1941). The West Virginia tire-condition survey was used with North Carolina data in this study.

The most alarming aspect of these prophecies is: What will be the effect on the war effort if practically all civilian motor traffic disappears? It is difficult to see how the ensuing dislocation of practically all activities can fail to hamper the war effort. Some opinion to the contrary notwithstanding, not much of this 80%, or 100% as it would soon become, of passenger car traffic is non-essential. And the present outlook offers little hope that trucks will escape the same fate.

Public Roads Administration

MANY MAIN ROADS HAVE SURPLUS CAPACITY, SUCH AS THIS DIVIDED HIGHWAY IN DELAWARE

Can this country go back to the horse-and-buggy days—without the horses and buggies—and still produce a national income that will support the war? Each may answer that question for himself, but I think all must agree that the No. 1 wartime road problem is the production of some substitute for rubber tires. I have faith that this will be accomplished. However, it is not a problem that civil engineers can solve.

Certainly a premium must be put upon keeping existing equipment going. In this respect the getting of repair parts will probably become a serious problem. A minimum of steel is available for road and bridge work. This will necessitate very decided changes in design. Lack of other critical materials will force us to adopt new methods of various sorts. Obviously the changes in emphasis from the devising of better and more economical methods to the speeding of war traffic at all costs leave little place for fundamental research. On the other hand the need for conserving what we have and preparing for a post-war future indicates that we must keep at least a minimum of research going.

For twenty years the Highway Research Board has fostered technical development in all phases of highway interest. In this emergency the Board believes it can help by transmitting to engineers, in usable form, the best available information on those phases of highway technology for which common practice has not been established or where accepted practice must now be modified to conform to wartime limitations. To this end a series of bulletins on "Wartime Road Problems" is in preparation. We also recognize that it is our duty to keep the research spark alive through the dark days so that we will be at least in starting position when the post-war need comes.

DOING WITHOUT

No matter what our personal opinions, the fact is that little steel will be available for concrete pavements. Fortunately technology is so well advanced that it should be possible to produce sound recommendations for wartime use.

Critical materials are largely involved in current curing practice. Willy-nilly, we will have to get along without them, and at the same time maintain quality. Guard rails are a necessity; on their design a great deal of ingenuity has been displayed. But steel plays an important part in them and now we must go back for a time and devise structures of timber which will be far better than the old wooden rails.

Other highway elements that we must learn to produce without critical materials include traffic and protective paints, signs and signals, and small waterway structures. Highway bridges must be designed with a minimum of steel. Reinforced concrete can in many cases take the place of structural steel, and timber will be extensively used in place of either. The problem will not be to get the most economical structure; what one engineer has dubbed "monstrosities" will have to be built. The job will be to get something adequate in service quickly, using whatever can be had.

ADVANCED TECHNOLOGY

There is always a lag between research development and practical utilization. To some extent this serves the useful purpose of providing a tryout period; but undoubtedly in times such as these some closing of this gap is needed. Intensified dissemination of the best available knowledge is an engineering responsibility. In this category come such highway matters as soil stabilization methods and conditions of use for surfaces and subgrades, compaction of embankments, drainage, reduction of frost damage, and elimination of volume changes in the subgrade due to other causes than frost.

Since existing roads must be conserved, it is imperative that the most effective methods of strengthening and repair be made known to those who carry this responsibility. Investigations have been made—some are in progress now—on various relations of vehicles, tires, and pavements which should be helpful to many, particularly to operators of fleets of trucks and buses, in extending the services of their units to the utmost. Traffic engineers have their own set of problems in connection with operation under blackout conditions, avoidance of interference between military and civilian movement, and safety under new and unusual conditions.

Public Roads Administration

A SUBSTITUTION FOR CRITICAL MATERIALS—COMPACTING A CEMENT STABILIZED BASE FOR BITUMINOUS TREATED SURFACE

Typical of certain engineering questions upon which research should be accelerated rather than put aside is the design of flexible-type pavements. The interrelationships among load, pavement, base, sub-base, and foundation soil are indeed complicated, and so far the fundamental principles have not been established although an impressive amount of scientific research in soil mechanics relating to this problem has been done. While the available record of experience under a wide variety of conditions gives us a usable guide, more specific design methods are needed, particularly where the design must be adapted to much heavier loads than we are accustomed to.

An outstanding need is for definite methods of determining the load-bearing capacity of existing roads where wartime use requires that they carry the maximum that will not cause failure. Also there is a pressing need for further experimental data on the relations between static and moving loads, pavement deflections, characteristics of underlying material, and behavior in service.

The restrictions that must be imposed upon road work will insure that whatever such work is done will be essential to the war effort. Those engaged in it may well feel that they are doing their part until called to duties still more important.

Water Softening at Twin Cities Plants

THE trend toward water softening in the United States is well illustrated by the operation of the plants at Minneapolis and St. Paul, here described. Both plants are comparatively new—that at Minneapolis was constructed between 1936 and 1941, while the one at St. Paul dates from 1939–1940. Both plants draw their supply from the Mississippi River—the latter through a series of lakes and the former directly. The operating experience here given for these two plants forms a worth-while addition to the notebooks of sanitary engineers. Messrs. Thompson and Jensen presented their papers originally before the session of the Sanitary Engineering Division at the Society's Minneapolis Convention.

Experience with St. Paul Softening Plant

By L. N. THOMPSON
SUPERINTENDENT OF WATER DEPARTMENT, ST. PAUL, MINN.

THE original St. Paul treatment plant, constructed in 1920–1921, is a typical rapid sand filter with over-and-under type mixing chambers, coagulation or settling basins, the typical rectangular concrete box filters, chemical storage, and a separate 16-million-gal filtered-water reservoir used also for the supply of wash water. Clear wells for the storage of the filtered water are located under the filters. From these wells the filtered water flows directly to the main pumping station for distribution. The softening plant was constructed in 1939 and 1940.

Initially there was no public demand for a softer water, but increased consumption indicated to the department the need for increased filtering, mixing, and coagulation capacities. As plans progressed, the department became convinced of the desirability of so designing the extension that its conversion to a softening plant, if and when that demand developed, could be accomplished with a minimum of delay and expenditure. As it developed, however, demands for soft water actually preceded even final completion of the additions, and conversion of the project to a softening plant began after construction was well under way. The new plant increased capacities from a maximum of 60 to 90 million gal daily.

Design of the new plant made use of all existing facilities and structures. The necessity of maintaining the existing plant in full operation while the additional structures were being built influenced both design and construction methods. As finally built, the new structures include a flocculator room, two circular tank clarifiers, a recarbonation chamber and chemical storage, and the necessary mechanical equipment for water softening.

Water enters the plant through a 60-in. steel and 48-in. cast-iron conduit directly into one end of the over-and-under type mixing chambers, passes to the new flocculator chamber, splits and flows to the two clarifiers, through the recarbonation chamber, to the two old coagulation basins now used as secondary settling basins. It then flows to the 18 filters, thence through 6 clear wells lying directly under the filters, to the pumps for distribution to one of several large storage reservoirs in the distribution system.

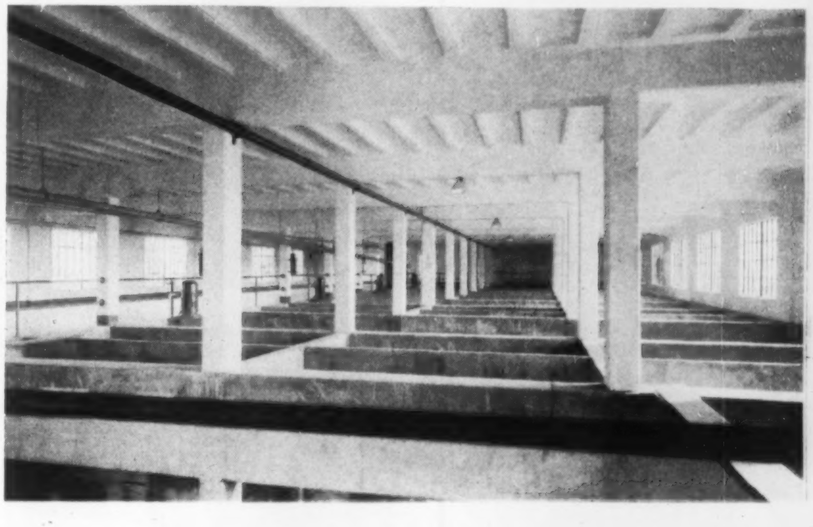
The flocculator basin, 46 ft wide by 140 ft long by 20 ft deep, built as an extension to the mixing chambers of the old plant, is equipped with five sets of paddle wheels, set with the drive shafts transverse to the flow. Each set of paddles is independently motor driven at one of four speeds. This type of flocculator equipment was chosen rather then the existing over-and-under baffle method, primarily to conserve hydraulic head.

The two clarifiers are each 150 ft in diameter, approximately 20 ft deep, and covered with clear-span roofs. They are equipped with circular-type sludge-removal equipment which can continuously collect the deposited sludge from the bottom of the clarifier and discharge it at the center of the tank, thence to the sludge pump-room located between the clarifiers, whence it is pumped to drying beds or returned in part to the plant for mixing with the incoming raw water. A recarbonation chamber is adjacent to the flocculator room.

CHARACTER OF WATER TREATED

Approximately 8½ billion gal of water is treated annually. The main source of supply is the Mississippi River. The intake is a few miles above that for the city of Minneapolis and some 15 miles from the city of St. Paul. The river water passes through a chain of three lakes, having a combined available storage of 7 billion gal, before it reaches the filter plant. This supply may be augmented from a second series of lakes. Data show that by passing the river water through the lakes the bacterial population is reduced, and the color and turbidity are improved. However, the physical qualities of the water are not greatly improved, and the odor is but slightly reduced. The chemical quality of the water fails to show any marked benefit and micro-organisms are very much increased by travel through the lakes. The combined data indicate that while there are both gains and losses, the gains of lake storage probably slightly outweigh the losses.

Softening was desired because the raw water had an average hardness of 176 ppm, of which 27 ppm was per-



FLOCCULATION ROOM IN ST. PAUL WATER SOFTENING PLANT

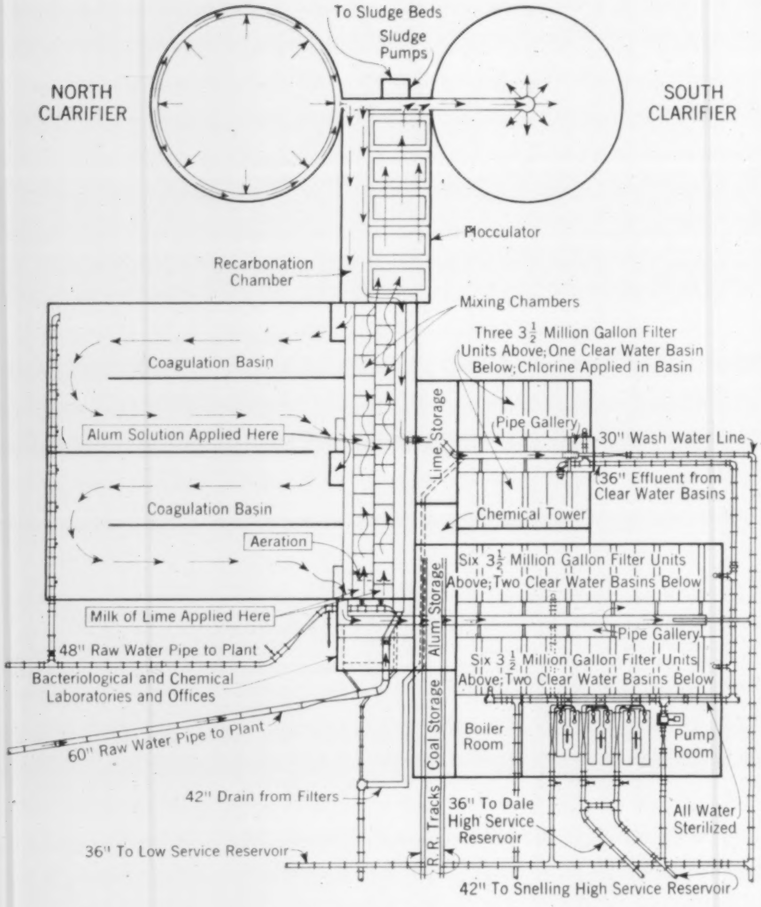
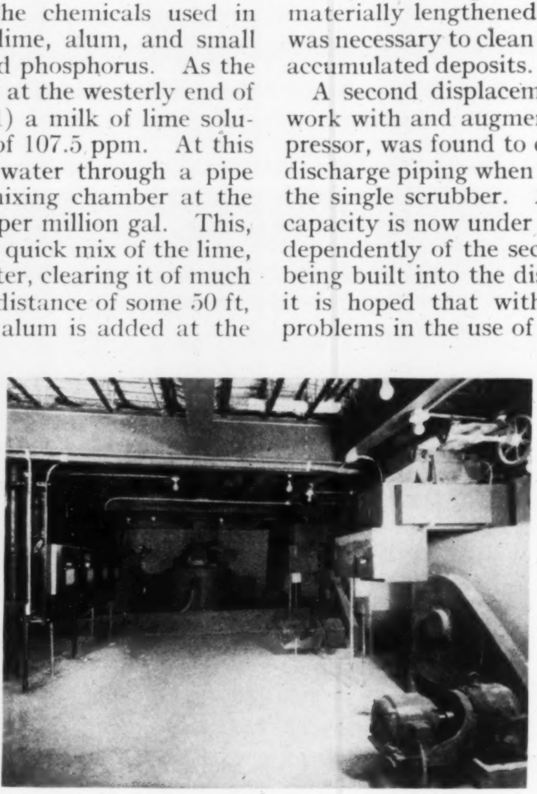

To Sludge Beds
Sludge Pumps
NORTH CLARIFIER
SOUTH CLARIFIER
Flocculator
Recarbonation Chamber
Mixing Chambers
Three 3½ Million Gallon Filter Units Above; One Clear Water Basin Below; Chlorine Applied in Basin
Coagulation Basin
Pipe Gallery
30" Wash Water Line
Lime Storage
Alum Solution Applied Here
36" Effluent from Clear Water Basins
Coagulation Basin
Chemical Tower
Aeration
Six 3½ Million Gallon Filter Units Above; Two Clear Water Basins Below
Alum Storage
Milk of Lime Applied Here
Pipe Gallery
48" Raw Water Pipe to Plant
Six 3½ Million Gallon Filter Units Above; Two Clear Water Basins Below
Bacteriological and Chemical Laboratories and Offices
Coal Storage
Boiler Room
Pump Room
60" Raw Water Pipe to Plant
42" Drain from Filters
R. R. Tracks
36" To Dale High Service Reservoir
All Water Sterilized
36" To Low Service Reservoir
42" To Snelling High Service Reservoir

FIG. 1. PLAN OF ST. PAUL FILTER PLANT, MAIN PUMPING STATION

manent and 149 temporary. The chemicals used in the treatment of the water are lime, alum, and small amounts of ammonium sulfate and phosphorus. As the raw or lake water enters the plant at the westerly end of the south mixing chamber (Fig. 1) a milk of lime solution is added at the average rate of 107.5 ppm. At this point air is introduced into the water through a pipe manifold in the bottom of the mixing chamber at the rate of approximately 6,000 cu ft per million gal. This, we believe, serves the purpose of a quick mix of the lime, and oxidizes and ventilates the water, clearing it of much of the dissolved gases. Within a distance of some 50 ft, following the application of lime, alum is added at the average rate of 8.8 ppm.

Mixing and coagulation are continued through the mixing chamber and flocculators, with an average detention period of 60 min. The water from the clarifiers is drawn off over peripheral weirs after a normal detention period of 4 hours. Following clarification, carbon dioxide gas is added at the rate of 3,600 cu ft per million gal. Ammonium sulfate and phosphorus are added as the water leaves the secondary settling basins, or before filtration, at rates of 0.16 and 0.092 ppm, respectively. Chlorine is added in each clear well immediately after filtration at the rate of 0.81 ppm.



CHEMICAL CONTROL AND FEED EQUIPMENT ADDS LIME, ALUM, AND SMALL AMOUNTS OF ADDITIONAL CHEMICALS TO RAW LAKE WATER

All chemicals are applied continuously at the rate of application determined in the laboratory. Lime and alum are fed through gravimetric-type feeders, designed to operate within a 2% limit of accuracy. All chemicals are delivered into the plant in specially designed hopper-bottom, closed cars, and unloaded pneumatically into storage or auxiliary bins.

Gases from the stack of the boiler room contain an average of 12% of carbon dioxide (CO_2), which is partially recovered. A 1,000-cu ft rotary compressor, located in a room near the mixing chambers, pulls the gases from the point of take-off at the boiler breeching, through a 12 by 18-in. metal duct, a distance of about 200 ft. The gases first pass through a scrubber containing limestone and metal filings, in which they move upward against a stream of water. Early operation produced a sticky and very fine sooty deposit on the ducts and impeller of the compressor. Reduction in the amount of water used in the scrubber reduced the stickiness of the deposit, but this water could not be further reduced because of the heat of the gases entering the compressor.

First efforts to correct the trouble were the introduction of a cyclone ash remover that performed efficiently by removing at least 90% of the fly ash from the stack gases used. To remove the rest, which was extremely fine, we designed a series of bag filters made of glass fiber cloth. These proved unsatisfactory from the standpoint of wear and were later replaced by wool bags, which have given fair service. Later a large plenum chamber, 7 by 7 by 40 ft long, was built in the line and has very materially lengthened the time between periods when it was necessary to clean the scrubber and compressor of the accumulated deposits.

A second displacement-type compressor, designed to work with and augment the capacity of the rotary compressor, was found to cause considerable vibration in the discharge piping when the two were run together through the single scrubber. A second scrubber of much larger capacity is now under construction, designed to work independently of the second compressor. Dryers are also being built into the discharge side of each scrubber, and it is hoped that with these improvements the major problems in the use of stack gases will be solved. From the compressor room the CO_2 gas is pumped to the recarbonation chamber, where it is automatically controlled and applied to the clarified water through a cast-iron grid system in the floor of the chamber.

When the softening plant was first placed in operation in January 1940, a pH of 9.5 was maintained in the recarbonation chamber, but it was soon discovered that the water was very unstable at this point, and considerable difficulty was experienced in the distribution system from deposits in the hot water coils. Calgon and hexametaphosphate were introduced into the water after filtration in an attempt to sta-

Scrubber Through Which Passes CO_2 Recovered from Boiler Stack Gases

bilize it, but results were questionable. An attempt to reduce the pH to 8.5 resulted in taste and odor trouble. A pH of 9.5 is now maintained at the first point of application of the CO_2 gas in the recarbonation chamber, and following filtration additional CO_2 is added in the clear wells to produce a pH of 8.5. This procedure has given very good results, and provides a very stable water of excellent taste. The total hardness of the finished product is between 75 and 80.

The original filter beds were constructed with a 16-in. gravel bed laid on 1 by 6-in. wood-slat bottoms. Some little difficulty has been experienced from spreading of the boards and dislocation of the gravel beds, and the new filter beds are constructed with pre-cast concrete blocks. All filters are designed to handle a normal flow of 3$^1/_2$ mgd and a maximum of 5 mgd, with wash water rates at 30-in. rise on the new filters and 24-in. on the old ones. A recent general cleaning of the filter sand was accomplished by the use of a movable electric-driven dredge pump with a capacity of 1,150 gal per min. This pump, set at one filter at a time, drew its suction from the sand bed and discharged directly into the same bed. The low wash rate used during pumping carried the suspended matter to the sewer. The pumping was continued at each filter until the water was clear, which required about 14 hours and involved passing the sand through the pump about 25 times.

Two sludge pumps installed in a separate pump-room remove the accumulated sludge from the clarifiers by suction through 20-in. pipe lines. Approximately 50% of the sludge is returned to the plant and introduced into the mixing chambers, producing a better floc and reducing the amount of lime required. The balance of the sludge, running about 90% water, is pumped to three large sludge beds some 1,500 ft distant from the plant proper. These beds are operated alternately to allow drying. Approximately 10,000 tons of calcium and magnesium (dry) sludge are removed annually, and these beds will probably last several years, as the available storage is about 60,000 cu yd. The dried sludge removed from one bed tested about 45% water. Some has been removed by farmers to spread over their fields. This method of handling sludge is not highly satisfactory, and considerable thought is now being given to reclamation of the sludge lime.

The entire design was made with the aim of securing flexibility in operation. The plant can very readily be converted to the old standard filter type by entirely eliminating the use of lime and CO_2 gas. The flocculator and one or both clarifiers may be by-passed.

FINANCIAL CONSIDERATIONS

Cost of filtration and softening is $13.91 per million gal. The annual costs for softening alone approximate $50,000, giving savings to the consumer estimated at $300,000 a year. Although in the two years of operation we have had innumerable minor problems, at no time have we had to shut down the plant. Disturbances in the quality of the water, which occurred twice, were probably caused by our own inexperience and were of short duration. At one time a financial difficulty threatened the purchase of lime and consequent stoppage of water softening. However, the situation soon made all parties concerned realize the popularity of a softened water with the consumers.

Purification and Softening at Minneapolis

By J. A. Jensen

Superintendent of Water Works, Minneapolis, Minn.

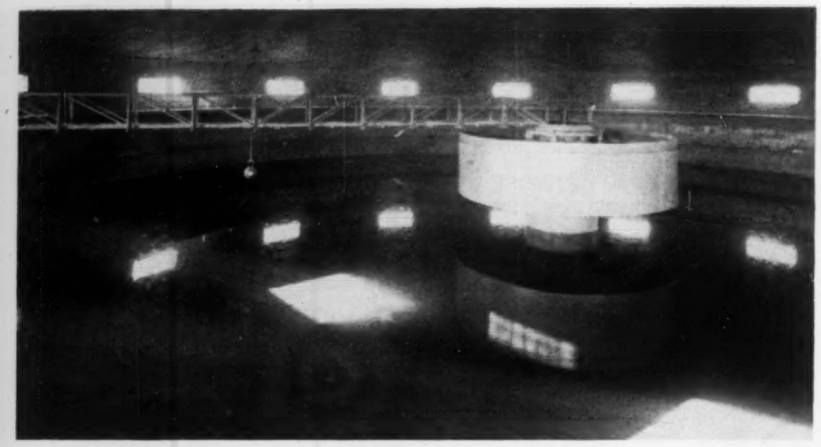
Since the establishment of standard methods of water treatment and filtration, water works officials and technicians have endeavored in every possible way to improve the quality of water supplies by the development of methods and means suitable for this purpose.

Chlorination of the water supply for Minneapolis was initiated in 1908, and in 1913 filtration was begun at Columbia Heights. In 1927 a second plant located at the river near Fridley was placed in service. These plants now provide 50 mgd to 500,000 people.

After nearly thirty years of filtration experience, and considering the character of the water supply, it was deemed advisable to consider further tempering of the water, by softening, not only to reduce the mineral content, which contributed to hardness, but also to reduce the organic content, which contributed to chlorinous tastes and odors that might be prevalent in filtered water. These improvements would then provide a water of uniform hardness and reduce color and other organic troubles.

In these studies extensive artesian-well development and the use of water from Lake Superior were considered but were rejected because of inadequacy or prohibitive cost. The construction of the water softening plant for Minneapolis was initiated in 1936 and completed in 1941. The plant is located on the river near Fridley. The softened water is delivered to the two filter plants, where filtration and delivery to the city are done in the usual

Minneapolis Softening Plant Nearing Completion on Bank of Mississippi River



PRECIPITATORS AND RECARBONATION CHAMBERS EMERGING FROM FORM WORK

manner. The salient portions of the softening devices consist of precipitator-type basins employing the features afforded by the cone-form reaction chamber now well known to water works men. Vertical flow downward and upward, decreasing in velocity as the area increases, thereby affecting the carrying power of the water, is a noteworthy and effective method in precipitation control.

These basins are notable for their size. The top of the outer cone is 85 ft in diameter, and the individual overflow weir is 267 ft in length. The total length of the combined weirs is 3,204 ft. The normal vertical rise at weir level at rated capacity is 2 in. per min. Each precipitator has a nominal capacity of 10 mgd, and the total capacity is 120 mgd.

CHEMICAL TREATMENT

For the past ten years, 1932 to 1941 inclusive, the average calculated hardness of the raw water was 175 ppm with a maximum of 262 ppm and a minimum of 127 ppm. The maximum hardness occurred in January 1940 and the minimum in April 1936. The average raw-water color for the same ten-year period was 43 ppm, with the maximum of 190 ppm in 1941 and the minimum of 12 ppm in 1935.

The chemical treatment is designed to produce a finished water hardness of about 75 ppm and to reduce the color to not more than 15 ppm. The chemicals used in the softening plant for one year's operation, in terms of grains per gallon, have averaged as follows: lime, 8.13; alum, 0.96; soda ash, 1.67; and ferrous sulfate, 0.43.

During periods of exceptionally high color, the raw water is first partly decolorized at one of the filtration plants and then softened. In September 1941, when the color reached 95 ppm, it was found necessary to decolorize the raw water before softening. During 1942 it was possible to soften the raw water directly without decolorization even though the color reached was as high as 140 ppm.

Lime is added for the purpose of precipitating the calcium and magnesium salts which are present as bicarbonates, while the addition of soda ash is to remove the non-carbonate hardness. The calcium is precipitated as calcium carbonate while the magnesium is removed as an insoluble hydrate. The ratio of calcium to magnesium in the raw water is about three to one. For 1941 the calcium was 45.4 ppm and the magnesium was 15.5 ppm. The non-carbonate hardness in the raw water, which may vary from 15 to 25 ppm, is caused principally by the presence of calcium and magnesium sulfate. The application of aluminum sulfate or ferrous sulfate is for the purpose of aiding coagulation in the softening process, and these chemicals are also adjuncts in color and turbidity reduction.

Residual color in the softened water is further reduced in the filtration plants by the addition of aluminum sulfate. This treatment, besides conditioning the water for filtration, reduces the alkaline intensity, or pH value, and tends to stabilize the water. The pH value of the water leaving the softening plant has been about 10.5, while the pH of the finished water has been lowered to about 8.0 to 8.5. A phosphate compound was used during the early months of water softening but is not required at present.

The benefits derived from softening, other than reduction of the calcium and magnesium salts, are the elimination of soluble iron and manganese compounds, and the additional reduction in the bacterial and organic content before filtration.

During the year's operation the only trouble that arose was a deposit of alumina-magnesium-silica compound in submerged or high-temperature water heating tubes. Since no recarbonation equipment was installed—it was held up by war priorities—the formation of these deposits had to be handled by the use of filter alum to reduce the pH to a range of 8.3 to 8.7. This has eliminated the trouble.

The public reaction to the use of softened water has been very gratifying. It has proved economical in the use of soap and washing compounds, agreeable for household purposes, and in demand for many commercial uses where soft water is needed. Softening has inhibited chlorinous tastes and odors, and the water is considered a very satisfactory potable product.

In the country as a whole, the water softening industry has grown from a single plant in 1905 to 575 plants in 1941, which serve about 800 communities. Of these, 467 plants are municipally owned. There are 199 municipal zeolite plants and 377 chemical precipitation plants which serve 10 million people with softened water. The plants treat well waters in 368 cases, river and stream supplies in 133 cases, and impounded and spring supplies in 79 cases. Twenty-three plants supply softened water to as many communities ranging from 50,000 to over one million people each.

Twenty years ago 100 ppm of hardness in tap water was considered desirable but now 50 to 80 ppm is held a suitable range, within proper stabilization control. Water softening has required an additional outlay for production, but these costs are largely offset by the attendant economies to the users. In general the advantages more than outweigh the expense.

REINFORCED CONCRETE FRAMING OF CONICAL PRECIPITATORS

Trained Timber Designers Needed

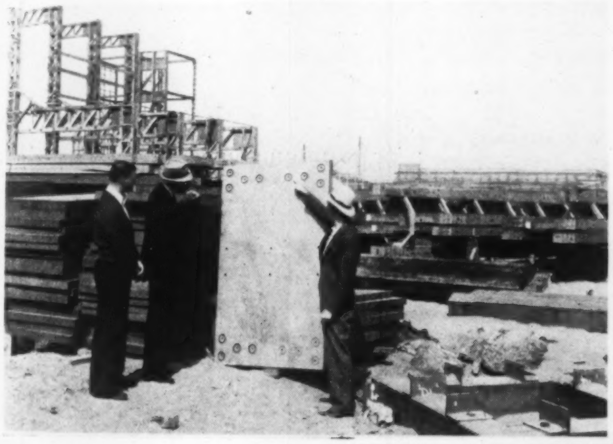
A Plea for Wider Teaching of Important Design Developments

By Howard J. Hansen, Assoc. M. Am. Soc. C.E.

Associate Professor of Civil Engineering, Agricultural and Mechanical College of Texas, College Station, Tex.

Once again wood is being called upon to take its place in the design and construction of large engineering structures while other materials are on the critical list for the manufacture of armaments and weapons. This time, however, the lumber industry is equipped with a multitude of data that, when properly used in designing timber structures, will result in just as efficient and economical a structure as could be constructed with other materials. Professor Hansen stresses the importance of arming students with the design knowledge which will enable them to use effectively this abundant and easily processed material.

It has only been during the past sixteen years that developments in wood technology have opened up an abundance of new applications. These have been due primarily to scientific studies by the Forest Products Laboratory at Madison, Wis. Prior to about 1926 the only data available for use in the assignment of working stresses to structural lumber were the results of thousands of tests on small clear specimens. These tests were extremely valuable and later served as the basis for further research, but they did not supply the designer with a definite means of writing specifications for large structural sizes containing knots, checks, and other defects. Consequently the working stresses assigned to like material throughout the country differed widely and some building codes varied as much as 100%.



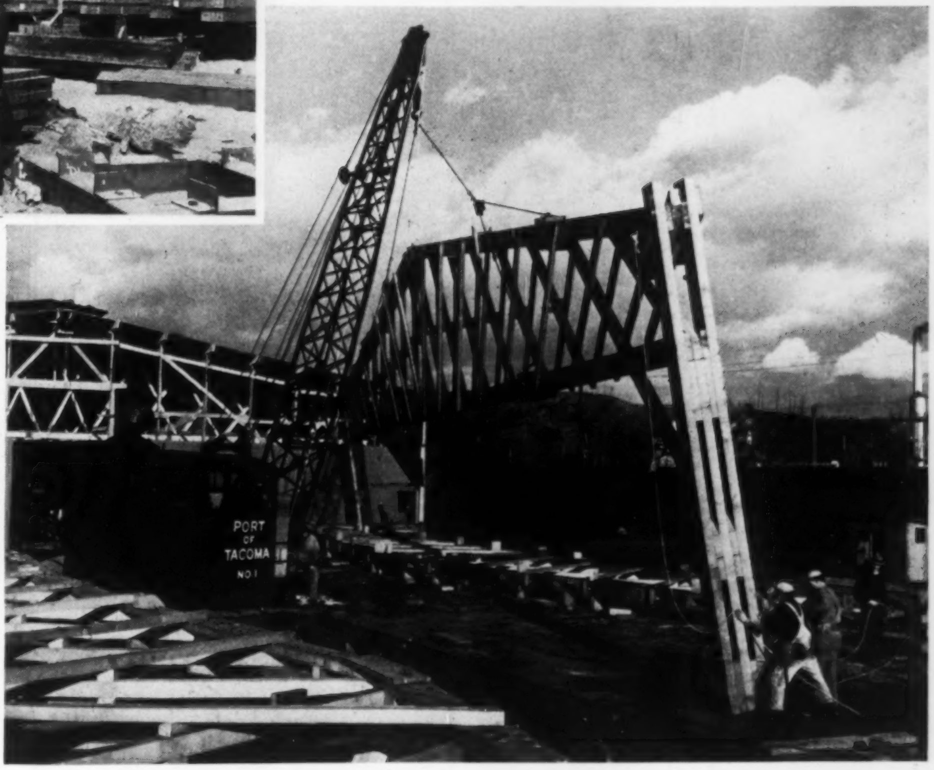
Plywood Web Member 3 In. Thick
Note Timber Connectors for Attachment to Columns and Trusses

In 1930 the results of studies by L. J. Markwardt at the Forest Products Laboratory on the comparative strength properties of woods grown in the United States were published. This research made it possible to establish safe working stresses for commercial structural grades. In the same year an extensive series of tests on large timber columns was reported by J. A. Newlin, M. Am. Soc. C.E. and J. M. Cahagan. The results of these tests furnished the designer with the dependable column formulas which are in use today.

In 1932 the results of tests at the Forest Products Laboratory on the bearing strength of American timbers under bolts were published in a report by G. W. Trayer. This booklet presented the basic stresses for the bearing value of all species when used with bolts, and their method of application in the design of bolted joints.

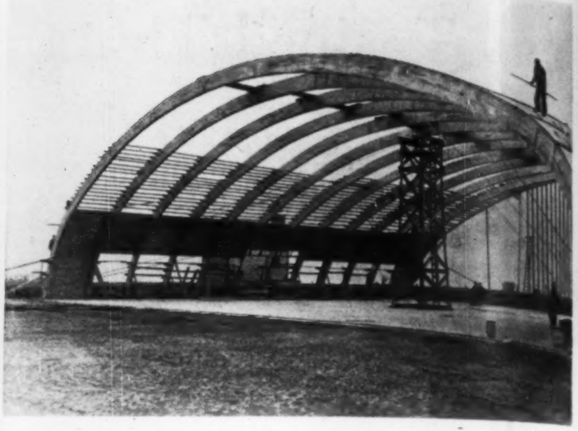
A LONG STEP FORWARD IN TIMBER DESIGN

Probably no single factor has played a greater part in revolutionizing timber design than the introduction into this country of modern timber connectors. The results of tests on many types of connectors were first reported in 1933 by Nelson S. Perkins, Peter Landsem, Assoc. M. Am. Soc. C.E., and G. W. Trayer. These tests formed the basis for assigning safe working loads to connectors when used with native woods. In 1934 the Timber Engineering Company of Washington, D.C., subsidiary of the National Lumber Manufacturers Association, ac-



Lattice Truss and Columns of a Complete Bent Being Raised Into Place

ARCHED TRUSS FOR HIGH BAY CAN BE EASILY ERECTED



LAMINATED ARCHES FOR HANGAR CONSTRUCTION

quired the patent rights on these connectors for the purpose of distributing them on a commercial basis. Since then many additional tests and refinements in manufacturing have been made. (See "Tests on Wood Joints with Metal Connectors," by E. George Stern, CIVIL ENGINEERING for May 1941; also "Timber Structures" by Laurence P. Keith, October 1942.)

These connectors are essentially metal rings or plates that are partly embedded in adjacent members to transmit the load from one to the other. They are used in combination with bolts of small diameters. Types of timber structures heretofore considered impractical because of the limitation of the joint stresses developed can now be efficiently constructed of timber. Formerly, timber structures designed with bolt connections only were conspicuous for their massiveness; for to provide sufficient bearing area for the bolts, it was necessary to use timber sizes beyond those needed for the design load. Timber connectors provide a joint as strong as the timber itself, and excess material can be eliminated. From 30 to 40% of the wood formerly required to carry a load can now be saved by this means.

A comparatively recent development in the use of wood was reported in 1939 by T. R. C. Wilson, senior engineer at the Forest Products Laboratory, in a booklet titled, "The Glued Laminated Wooden Arch." This report includes the results of tests on glued laminated members, specifications for material and construction, design stresses, and the theory of the arch as it relates to the design and analysis of such arches.

There are many advantages in the use of glued laminated construction for wooden members. It allows members to be built up from material that can be quickly dried and that is too small to be structurally useful otherwise. Moreover, the members can be built up to cross sections and lengths of a size not readily available in single pieces. In arch construction no intricate framing is necessary and the arch rib, which is a single cross section, has more fire resistance than a truss of smaller pieces designed to carry the same load. (See "Plywood and Laminated Timber Construction," Ira D. S. Kelly, CIVIL ENGINEERING for January 1940.)

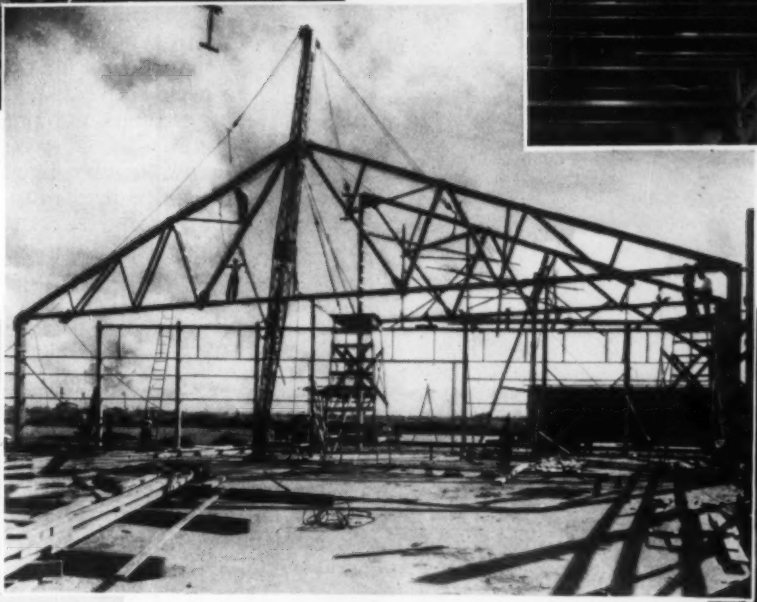
NEED FOR WIDER KNOWLEDGE OF PROPERTIES OF WOOD

In spite of all the data developed by research in the past sixteen years, which now make it possible to design in wood with the same degree of accuracy and efficiency as in other materials, the majority among the architectural and engineering professions have neglected to use this information to acquire a knowledge of the properties of wood. Consequently there is a general lack of appreciation of its possibilities. One reason for this can be found, no doubt, in the fact that few technical schools teach modern scientific design in wood. However, there is no reason why such a condition should continue to exist because wood is unlike any other structural material,

TEMPORARY WOOD TRESTLE 680 FT LONG TO CARRY TRAFFIC PENDING CONSTRUCTION OF PERMANENT BRIDGE

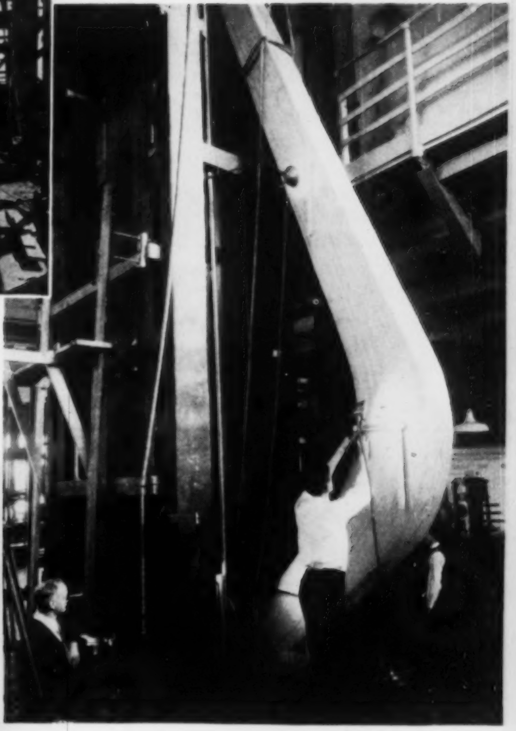
lit-Ring-Connected owstring Trusses anning 111-Ft Bay

Timber Framing Enhances the Appearance of an Army Camp Chapel

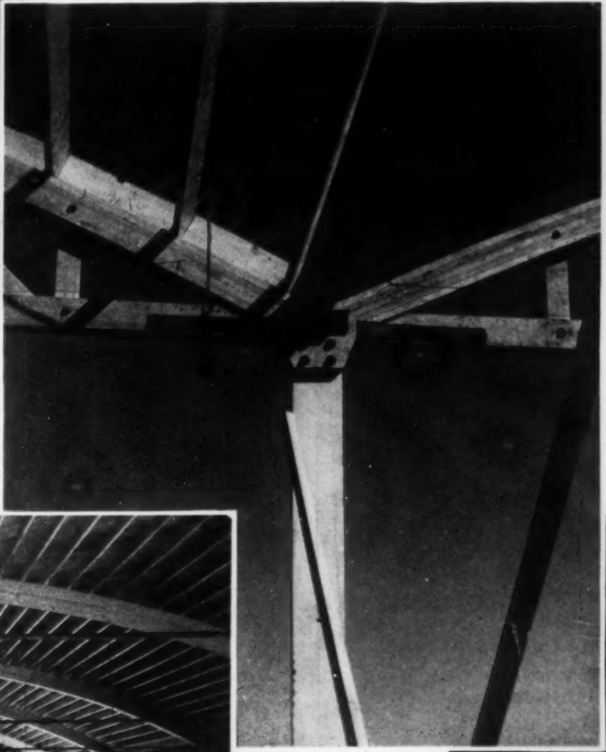


Erection of a 100-Ft Truss of Southern Pine

Prefabricated Sections of Roof Framing Speed a Wartime Housing Project

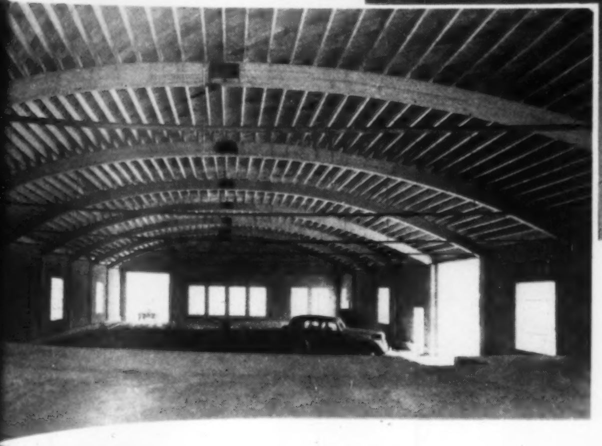


A Test in Progress on a Glued Laminated Arch at the Forest Products Laboratory

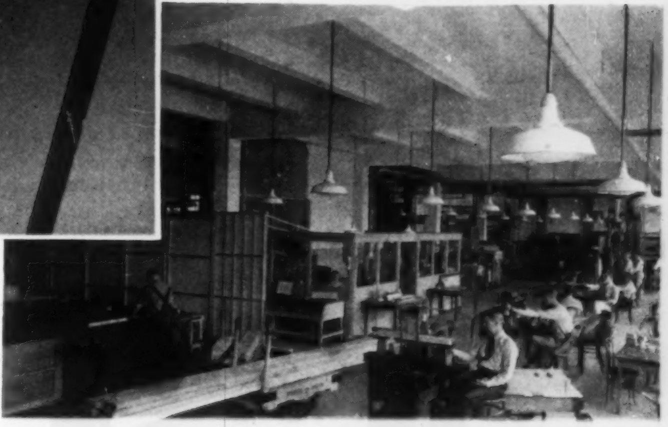


Simple Joint Details Made Possible by Laminated Gussets and Steel Strap

Glued Laminated Wood Arch with Tie Rods



Timber Mechanics Testing Laboratory at the Forest Products Laboratory, Madison, Wis.



FABRICATION OF LONG-SPAN TRUSSED ARCH FEATURING SPLIT SPLICE PLATES

and the principles employed in the design of structures made of other materials are not always applicable when wood is used.

For instance, it is readily conceived that if a transversely loaded square steel beam were placed in position with a diagonal vertical, it would, theoretically, carry less load than if it were resting on one face of its square. However, as found by actual tests, this is not true of wood. The beam formula for a square wooden beam so oriented that a diagonal of the section is vertical, requires a multiplier of 1.414, so that the general formula is written $M = \frac{1.414\ S\ I}{C}$. For a circular section, the addition of a multiplier is also necessary, and the beam formula becomes $M = \frac{1.18\ S\ I}{C}$. This shows that a wooden beam of circular section and one with a square section of equal area will sustain practically equal loads.

These numerical constants included in the beam formulas are called the form factors for the sections. The form factor was originally developed in tests at the U.S. Forest Products Laboratory, which showed that as the height of a beam increased, the modulus of rupture decreased slightly. However, this factor has already been considered in the unit working stresses for structural timbers, and when rectangular sections are used, it may be considered as unity. For I-forms and box-forms it is less than unity. Unlike stress, the modulus of elasticity is unaffected by the shape or form of the cross section. Consequently formulas for deflection due to bending stress require no modification because of the shape of the cross section.

Wood will carry a much greater load when it is applied parallel to the grain than when it is applied across the grain. How many engineers know the formula to use in obtaining the safe unit stress for wood when the load is applied at an angle to the grain? In the design of joints using connectors, the capacities of connectors decrease as the angle of the load to the grain increases. It is important, therefore, to be able to determine the member in which the load acts at an angle to the grain.

Are there many engineers who know the principles to apply in the use of unit working stresses for structural lumber grades? Of particular interest should be the fact that wooden beams will carry much greater loads for a few minutes than for a period of years. As the allowable working stresses are predicated on long-time loading, impact stresses which do not exceed allowable live-load stresses may be neglected in the design of wooden beams and stringers. Also of primary importance is a knowledge of spaced column formulas and their application. This is because the efficient design of wooden trusses, as well as other structures, requires the use of spaced compression members.

Tests at the Forest Products Laboratory have shown that a beam checked near the neutral plane acts partly as two beams and partly as a unit, and that part of the end reaction is resisted internally by each half of the beam acting independently, and consequently is not associated with shear at the neutral plane. Design procedure has been recommended (Newlin, Heck, and March) for calculating the horizontal shear on the neutral plane in checked beams.

Lumber is one of our greatest national resources, and what is more, full technical information is now available as to its properties and its use with connective devices and glues. It is therefore pertinent to ask why it should be longer neglected in undergraduate curricula. It is true, of course, that a few of the more progressive technical schools are teaching timber design, but more educators should grasp the opportunity that is now available for intensified scientific teaching regarding the proper use of this material.

SPLIT-RING-CONNECTED BOWSTRING TRUSSES FOR WIDE-BAY MANUFACTURING PLANT

A West Coast Cantonment

Part II. Organization of Construction Forces and Handling of Materials

By Charles T. Leeds, M. Am. Soc. C.E.
Consulting Engineer, Los Angeles, Calif.

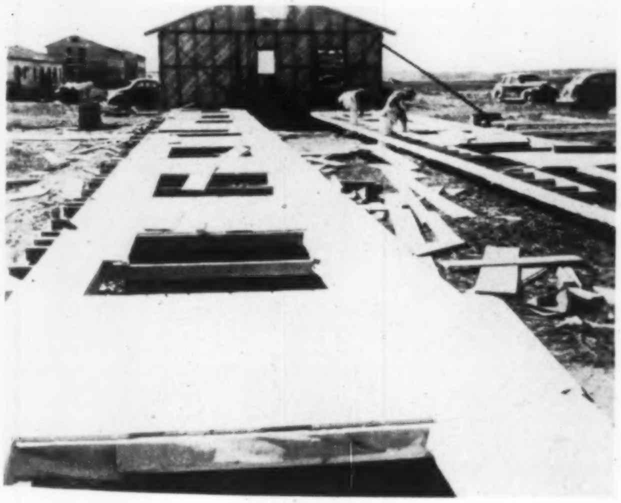
Concrete Overflow Weir of the Salt Water Barrier

Erection of this camp for 50,000 men required painstaking organization of forces to expedite the flow of materials to their place in the finished structures. As on all such war work, the greatest difficulty was probably the obtaining of materials and equipment, which depend upon priorities. For some parts of the work the contractor's field organization was understaffed and yet cooperation on the part of the engineers carried the job to successful completion. General features and design of the project were described by Colonel Leeds in the October issue.

Although typical plans for the structures of this military camp were furnished by the War Department, the topography and appropriate services required special investigation and adaptation of the basic plans. The tremendous task of the general contractor in securing materials and coordinating the work of the subcontractors was made easier through careful organization and cooperation of the several forces on the job. Unusual features of construction demanded the engineers' attention.

Location of the cantonment was determined largely by availability of water supply. In the development of this, particular care was taken not to infringe upon the rights of collateral owners. Wells were located downstream from all other water claimants, and to forestall any fear that the ground-water level would be lowered, all the return water from the camp, especially that from the motor equipment wash racks, was drained back into the river. Effluent from the sewage treatment plant was returned to the river valley downstream from the wells, both to replenish the ground water and to retard landward incursion of sea water.

In summer when the river flow drops to a minimum, sea water often flows upstream for a distance of four or five miles at high tide. There was some apprehension that seepage from this flow would reach down into the water-bearing strata. To protect and conserve the fresh water, a salt-water barrier was constructed across the valley. This consists of two earthen dikes, one extending out from each side of the valley, with a 1,100-ft concrete spillway in the center. The lip of the spillway is just above extreme high tide to prevent storm waves being driven upstream. The length of the spillway is such as to safely pass any probable flood. This barrier serves the dual purpose of keeping out the salt water at high tide and retaining the last of the flood runoff, giving it greater opportunity to percolate into the subterranean gravel beds which are the source of water supply for this entire region. The top of the dike was made wide enough for highway use and later was paved. A bridge over the spillway is now under construction to afford access from the camp to artillery ranges.



Wall Panels Assembled Before Being Raised Into Place

WATER SUPPLY FOR CONSTRUCTION

It was the responsibility of the contractor to provide his own water supply. The engineers, who had thoroughly investigated the problem and the local geology, advised him unofficially to obtain it from wells in the valley. Hoping to avoid the expense of a temporary 5-mile pipe line, however, considerable time and money were wasted in futile well drilling near the camp. The contractor finally decided to install a temporary pump in one of the 16-in. wells which had been drilled for the camp, and constructed a temporary 5-in. steel pipe line from the well to the camp.

Water for road sprinkling was obtained by installing a portable pump on the rocky shore line and filling tank wagons with sea water. This helped very materially to control dust during road construction.

It had been anticipated that one of the first items to be constructed would be the railroad spur from the main line to the warehouse area in camp. Skirting the camp area, it would have enabled the contractor to speed up his work by delivering construction materials directly to the site. However, owing to inability to obtain early delivery of rails, practically all materials had to be unloaded at railroad sidings on the main line 5 miles west or 8 miles north of camp, and hauled by truck or lumber carrier to the point of use.

CONTRACTOR'S ORGANIZATION

The contractor's organization at the camp was headed by a project manager having full responsibility for all construction activity, assisted in office work by a project engineer. A general superintendent headed the field crew of area superintendents and was assisted by a coordinator of subcontractors. The field organization was notable for the small overhead involved, which was kept at a minimum at all times. In fact, there were periods in the course of the work when the field organization was

PUMPING SEA WATER INTO A SPRINKLING TRUCK, USED TO SETTLE THE TROUBLESOME DUST

PREFABRICATION SPEEDED THE WORK—A PLUMBING CONTRACTOR ASSEMBLING DRAINAGE FIXTURES

ENORMOUS QUANTITIES OF LUMBER WERE HANDLED BY SPECIALLY DESIGNED EQUIPMENT

so small that it appeared to be undermanned to the point of handicapping progress.

Most of the work was done by subcontractors, only the concrete and carpentry work being handled directly by the general contractor. Concrete for building foundations was batched at a central plant and delivered to the sites by transit mixers. A few of the earlier buildings were supported on concrete piers. Continuous concrete footings for all exterior walls were then adopted as standard. This type of foundation provides greater stability against earthquake, costs less for formwork, and gives a cleaner substructure and increased construction speed.

Carpentry methods were those of a modern operator, including templating and standardizing layouts where there was sufficient duplication of a building type. Considerable pre-cutting of wood-frame members was done at a central mill, to and from which materials were handled by lumber carriers.

LABOR-SAVING MATERIALS AND EQUIPMENT

The equipment was of the latest type and was delivered in good running order. Radial arm saws with cutter edge, together with roller conveyors, were extensively used in the central pre-cutting mill. Portable generator sets and the latest type of hand-power saws were used to good advantage on the actual building sites.

One of the most noticeable advances in framing technique was the use of a stamped metal plate or "rafter seat," which replaced the compound cut between rafter and plate on all the mess halls and hospital barracks. The plates are spiked to the rafters before they are raised. When the rafters (or rafter assemblies) are lifted into place, a triangular projection on the under side of the metal seat is thrust against the outer edge of the support to which the rafter is to be fastened, thus assuring proper position.

Another noticeable economy was effected by the use of plywood gussets in place of standard knee braces in the roof trusses. The curved piece of waste plywood remaining after the gussets are cut is used at the peak of the truss. The gussets are stagger-spiked between the two 2 by 8-in. columns in the side walls and are side-spiked to the top chords. A cost analysis showed that the use of this type of truss on 9-ft centers, with intermediate collar-tied rafters on spacings of not more than 2 ft, produced a stiffer structure at a cost no greater than for the old knee-braced roof. The width of these buildings is 25 ft 4 in.

The plumbing contractor showed excellent understanding of mass production methods in his central prefabrication shop, at which "christmas trees" and other prefabricated plumbing assemblies were template cut and calked with air-driven calking irons.

Throughout the job union labor was employed, and at no time was there any apparent shortage. Though a labor peak of 8,000 to 10,000 men had been anticipated, the contractor's method of handling the work kept the peak below 6,000. There was little labor trouble on the job, such trouble being confined to an incipient strike by the "cat-skinners" at the start of the job, caused in part by difficult working conditions due to the excessive dust raised by grading. This dust was so fine and thick that masks had to be furnished to all equipment operators and inspectors.

DIFFICULTIES ENCOUNTERED

As on all such war work, the greatest difficulty was probably to obtain materials and equipment, which depended upon priorities. At first, the job was severely handicapped by a priority rating of A-1-J. As the work progressed this was raised to A-1-E, which helped considerably. Coordinating efforts of the OPM were also of great assistance.

In the early stages of the work, there was lack of coordination between the general contractor and his subcontractors. The appointment of a coordinator of subcontractors largely remedied this. Towards the end of the job, however, the general contractor's field organization was so understaffed that the engineer's inspection forces had to do much of the coordination in clean-up work which should have been done by the general contractor's own field organization.

During the latter weeks of the contractor's work on buildings, both his office force and his field forces made continuous and increasing use of the very complete "check list" which the Buildings Division of the Engineer-Architect had set up as part of its regular work.

On this project the usual difficulties arising out of differences of opinion between the contractor's forces and the inspection personnel were almost negligible. This was due not only to the spirit of cooperation in both organizations, but also in large measure to the fact that the Engineer-Architect's field forces consisted of men of recent responsible construction experience, instead of what are sometimes called "career" inspectors.

The contractor's work was well handled and in many ways above average. It could have proceeded more rapidly if progress and advance planning charts had been furnished by the contractor as directed, and if periodic meetings for discussion of the work could have been held. Had such meetings for a general discussion of job problems been held at least twice a week, difficulties could have been anticipated and ironed out beforehand, and many misunderstandings avoided. This policy had been followed by the Engineer-Architect in previous cantonment construction of major proportions with very excellent results.

Testing Theoretical Losses in Open Channel Flow

Part I. Superelevation at Bends

By J. G. Jobes, Assoc. M. Am. Soc. C.E.
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and J. H. Douma, Jun. Am. Soc. C.E.
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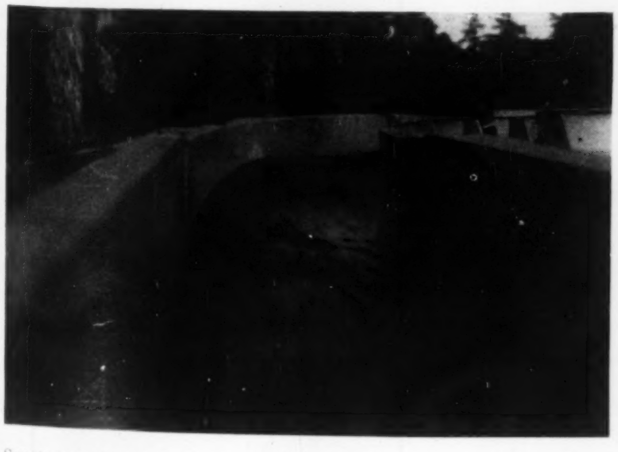
In the design of open channels it is necessary to take into consideration the superelevation of the water surface around bends. Wall heights must be determined to provide adequate protection against overtopping in reaches of excessive increase in flow depths. Lieutenant Jobes and Mr. Douma have reviewed and compared existing formulas for the computation of superelevation with the results of model experiments and field measurements. Part II, dealing with flow through bridge piers, will appear in a succeeding issue.

Superelevation in open channels is dependent upon the character of flow, and is quite different for tranquil and for rapid flow. The distinction between these two states of flow lies in the relation of the stream velocity to the celerity of an infinitesimal pressure wave. The celerity of a wave is determined by $\sqrt{gy}$, where g is the gravitational constant and y the mean depth of flow. When the stream velocity is less than $\sqrt{gy}$, the state of flow is tranquil, and when greater than this value, it is rapid. These states of flow are frequently referred to as the alternate stages of flow, the greater depth (above critical) being tranquil flow, and the smaller depth (below critical) being rapid flow.

Tranquil flow around a bend results in a rise in the water surface along the outside wall, due to centrifugal action, and a corresponding depression of the surface along the inside wall. Referring to Fig. 1, the magnitude of this disturbance in a rectangular channel is obtained by setting up a balance between the inward force due to the difference in water-surface elevation across the channel and the outward centrifugal force in a section normal to the direction of flow. The result is the following formula for superelevation (e_s) or maximum rise in water surface above the mean depth of flow in an equivalent straight reach:

$$e_s = {}^1/_2\,\frac{V^2b}{gr_c} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where V is the mean velocity of flow, b the channel width, g the gravitational constant, and r_c the center-line radius. The latter may be used in the formula because the channel width is small compared to the radius.



Superelevation at Bend in Model Channel at California Institute of Technology, Looking Downstream

This formula, Eq. 1, is based on the assumptions that the velocity distribution in a cross section is uniform and that all water filaments follow circular paths within the curved channel reach. Traverse measurements of velocity and model investigations of current directions in bends reveal that center and surface velocities are somewhat higher than the mean velocity, and that water filaments do not follow true circular paths but rather parabolic courses with shorter effective radii near the center of the bend. These factors increase the maximum superelevation. Experimental measurements indicate that this increase is as much as 50% of the superelevation computed by Eq. 1. A suitable design criterion for the maximum water depth at the outside wall of a rectangular channel with tranquil flow is given by the formula,

$$y + e_s = y + {}^3/_4\,\frac{V^2b}{gr_c} \ldots\ldots\ldots\ldots (2)$$

where y is the mean depth in a corresponding straight reach.

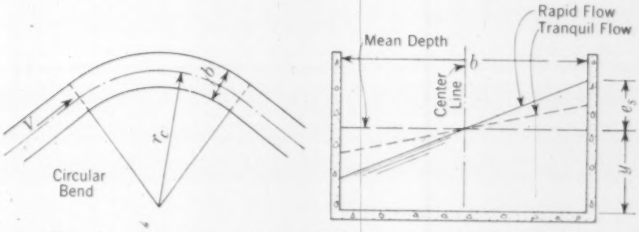


Fig. 1. Superelevation in Rectangular Channels

SUPERELEVATION WITH RAPID FLOW

Rapid flow, in which the stream velocity is greater than the velocity of wave propagation (supercritical velocity), does not produce superelevation in accordance with the formula for tranquil flow. The maximum superelevation is considerably greater, and it is not uniform around the bend but has maximum and minimum zones which persist for a considerable distance into the downstream tangent.

The change from a straight to a curved channel results in a disturbance which establishes definite transverse wave fronts extending downstream. In addition to the rise in water surface at the outside wall caused by centrifugal action, there is a continuing rise until the pressure of the attacking wave front is balanced by the pressure due to the increase in water level. Under these conditions, the differential in water level in a transverse section of channel is in excess of that required to balance centrifugal forces; therefore the flow does not continue downstream in equilibrium, but oscillates about equilibrium conditions not only throughout the bend but also for some distance in the downstream tangent.

For rapid flow, the magnitude of the maximum superelevation along the outside wall may be determined by setting up a balance between the force due to the difference in water-surface level across the channel, the centrifugal force developed by the bend, and the force required to decelerate the transverse wave. The resulting formula is

$$e_s = \frac{V^2 b}{g r_c} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

which is twice that obtained from theoretical considerations for tranquil flow (Fig. 1).

As for tranquil flow, the maximum superelevation is somewhat greater than that given by the theoretical formula, because of non-uniform velocity distribution and parabolic courses taken by water filaments. Theoretical approximations indicate that for rapid flow the maximum superelevation will be more accurately given by the equation,

$$e_s = \frac{1.2 V^2 b}{g r_c} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

SUPERELEVATION IN TRAPEZOIDAL CHANNELS

Discussion so far has been limited to rectangular cross sections, and the formulas presented apply only to this type of channel. In any attempt to derive similar theoretical formulas for superelevation in trapezoidal channels, it is necessary to recognize that the assumptions made in the analysis for rectangular channels would appear to have less justification when applied to trapezoidal cross sections. Deviations from the assumptions of uniform velocity distribution and circular paths of motion are probably greater than for rectangular channels. No attempt was made to derive theoretical formulas for superelevation in trapezoidal channels.

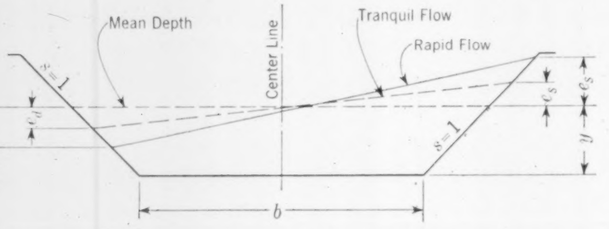


FIG. 2. SUPERELEVATION IN TRAPEZOIDAL CHANNELS

A comprehensive program of model experiments on superelevation in rectangular and trapezoidal curved open channels was completed in 1938 at the California Institute of Technology. These experiments, sponsored by the Los Angeles County Flood Control District, of which H. E. Hedger is chief engineer, were conducted under the direction of Dr. Robert T. Knapp and Dr. Arthur T. Ippen. From the results of their experiments, the Los Angeles Engineer Office derived the following formula for superelevation in trapezoidal channels:

$$e_s = \frac{CV^2(b + 2sy)}{2(gr_c - 2sV^2)} \quad \ldots\ldots\ldots\ldots (5)$$

where, in addition to the symbols previously explained, s is the channel side slope, and C is a constant whose value, determined from the results of the experiments, is recommended as 1.0 for tranquil flow and 2.0 for rapid flow (Fig. 2).

MODEL OF LOS ANGELES RIVER RECTANGULAR CHANNEL
Looking Upstream at First Bend in the Channel

The depression on the opposite side of the channel is obtained by the equation,

$$e_d = \frac{CV^2(b + 2sy)}{2(gr_c + 2sV^2)} \quad \ldots\ldots\ldots\ldots (6)$$

Again, the value of C is recommended as 1.0 for tranquil flow and 2.0 for rapid flow. The total maximum difference in water-surface levels at the inner and outer walls is given by the sum of Eqs. 5 and 6.

COMPARISON WITH MODEL EXPERIMENTS

No experimental data were available to the authors for comparison with the formulas presented for the case of tranquil flow in either rectangular or trapezoidal channels. Inasmuch as the superelevation for this case is usually small, because of low velocities, it is relatively unimportant in the determination of channel wall heights.

For the case of rapid flow in a rectangular channel, some of the results of the California Institute of Technology experiments, referred to previously, are plotted in Fig. 3 to show the agreement with the theoretical formulas. The model channel, shown in accompanying photographs, had a 1-ft width (b), 40-ft center-line radius (r_c), and 0.0996 invert slope (S). Rapid flow conditions existed for all the plotted measurements, as the mean velocity of flow was well above the computed wave celerity. The plotted points are in fairly consistent agreement with the curve computed from Eq. 4, which takes into account non-uniform velocity distribution and

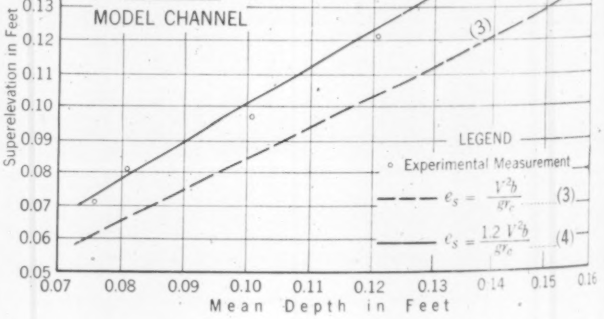


FIG. 3. COMPARISON OF THEORETICAL AND EXPERIMENTAL SUPERELEVATION WITH RAPID FLOW IN A RECTANGULAR CHANNEL

Transverse Wave Patterns Below the Channel Bend, Looking Upstream

the parabolic paths of water particles. As was anticipated by theoretical considerations, values computed by Eq. 3 fall somewhat below the experimental measurements.

In connection with the design of flood protection works and improvement of the Los Angeles River channel, the Los Angeles Engineer District has constructed an undistorted 1:50 scale model of the river from Dayton Avenue to above Fourth Street. This is shown in a photograph. A number of bends exist in this reach, but in most of them the flow conditions are extremely complex because of their location near transitions and bridge piers. To permit comparisons to be made of the model performance with the results of formulas, the superelevation was measured in a bend at First Street for both rectangular and trapezoidal model channel sections. This bend is preceded by a long reach of straight tangent and the model bridge pier was removed to eliminate its effect on the superelevation.

In Fig. 4, it will be noted that the experimental points lie between the curves for tranquil and rapid states of flow. Apparently this is because the flow is near the critical depth, although rapid flow conditions existed for all the measurements. It appears that a transition from the lower to the higher value of superelevation occurs as the condition of flow changes from tranquil to rapid. Insufficient data are available to substantiate this conclusion fully.

COMPARISON WITH FIELD MEASUREMENTS

Field observations of superelevation in rectangular channels were made on Sycamore and Rubio washes during the storm of February 12, 1936, and in Ballona Creek during the flood of March 2, 1938. These measurements afford an opportunity to compare field performance with theoretical and experimental results.

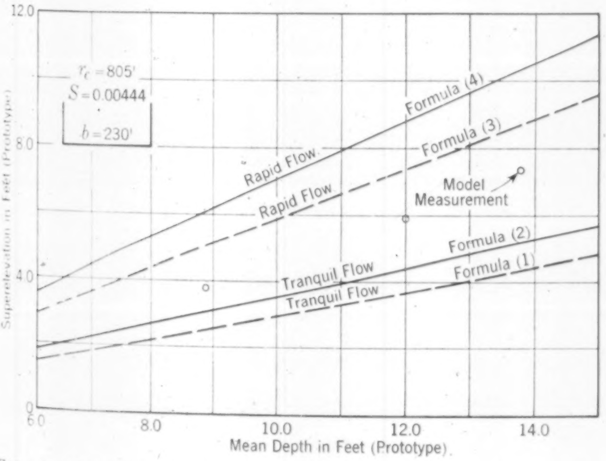


Fig. 4. Comparison of Measurements on Model of Los Angeles River with Theoretical Values

Pertinent hydraulic elements of these channels at points of observation were as follows:

	b	r_c	S (Invert Slope)
Sycamore Wash	9 ft	445 ft	0.008
Rubio Wash	26 ft	92 ft	0.0163
Ballona Creek	60 ft	556 ft	0.00124

Rapid flow conditions existed for all the observations on these three channels.

Referring to Fig. 5, the higher depth measurement in Sycamore Wash agrees with Eq. 4, but the lower depth observations fall below the curve of Eq. 3. Undoubtedly, the irregular invert shape had some effect on the superelevation for small depths of flow. Observations on the other channels compared favorably with the theoretical curves.

Superelevation measurements were also taken during the March 2, 1938, flood in curved trapezoidal sections of the Verdugo Wash and Ballona Creek channels. The Verdugo channel was a concrete section with 1 on $1^1/_2$ side slopes, a 43-ft base width, and a 1,500-ft center-line radius. The Ballona Creek section was trapezoidal rock paved with 1 on 3 side slopes, an 80-ft base width, and a 1,000-ft center-line radius. Rapid-flow conditions existed in the concrete Verdugo Wash channel, whereas flow was tranquil in the rock-paved Ballona Creek channel.

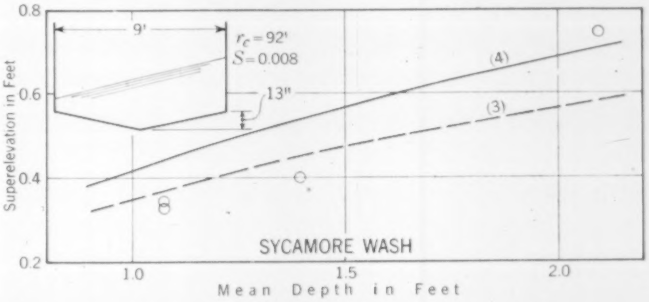


Fig. 5. Comparison of Field Measurements on Sycamore Wash with Theoretical Values

The two higher depth measurements in the Verdugo channel fell near the curve computed by Eqs. 5 and 6, which were based on the model experiments at the California Institute of Technology. As for rectangular channels, lower depth measurements appear to fall low. The superelevation with rapid flow in a trapezoidal channel is considerably in excess of that for an equivalent rectangular section.

The two Ballona Creek measurements agree closely with the results of the formulas for superelevation with tranquil flow in a trapezoidal channel. In the case of rapid flow, the superelevation is in excess of that computed for an equivalent rectangular section.

While the number of field observations are far from adequate for a conclusive comparison between field performance and theoretical computations, in general the formulas presented appear to be satisfactory design criteria for the computation of maximum superelevation in open channel flow.

There are certain corrective measures that can be employed to reduce the magnitude of superelevation in curved channels and eliminate the disturbance in the downstream tangent. Of these, compound curves and properly located sills are the most practicable. Disturbance waves of the same amplitude but of opposite phase from those produced by the main curve are introduced, which reduce the superelevation. The formulas given here, however, are applicable only to the case of a bend in the form of a simple curve.

Silt Problems

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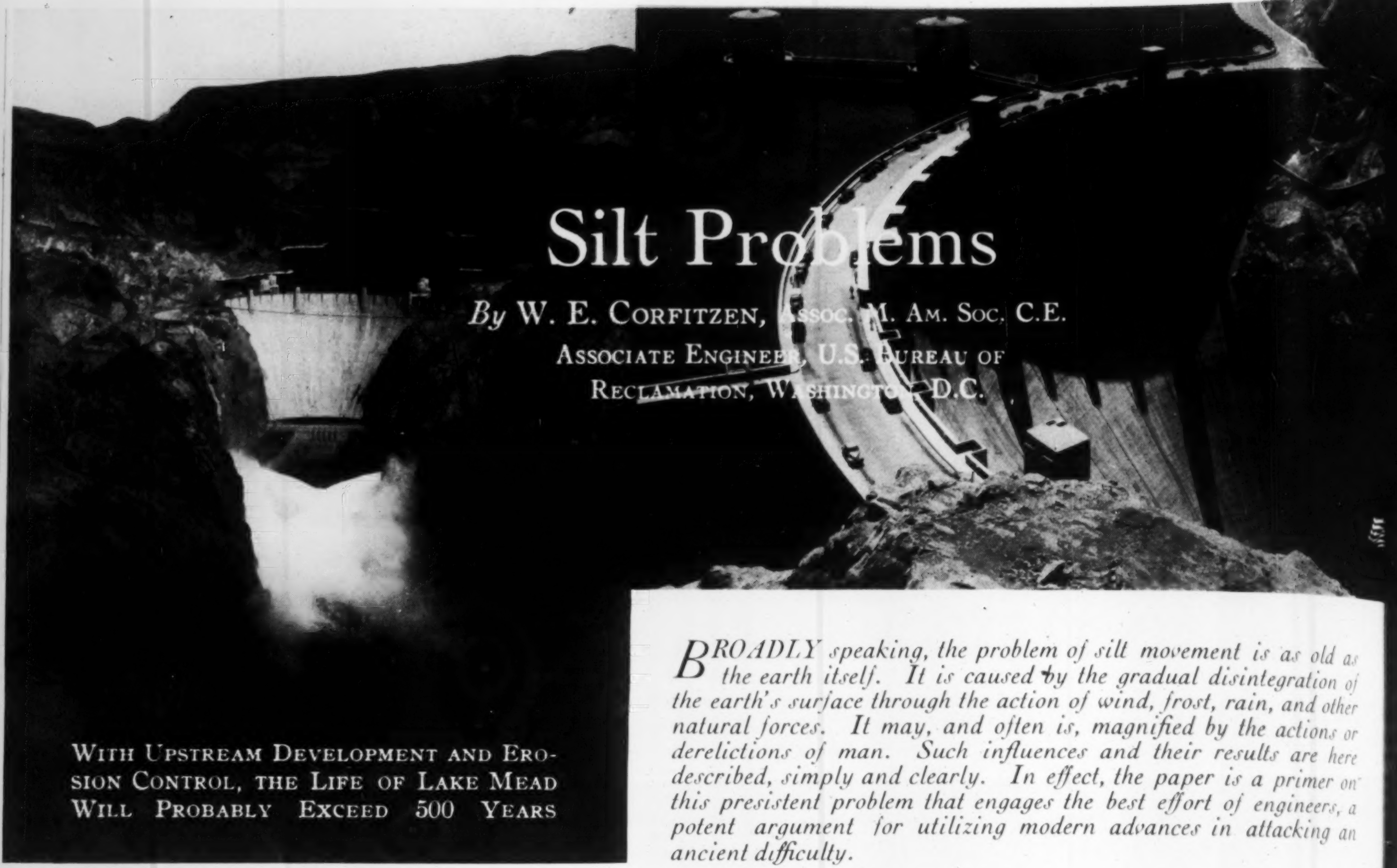


WITH UPSTREAM DEVELOPMENT AND EROSION CONTROL, THE LIFE OF LAKE MEAD WILL PROBABLY EXCEED 500 YEARS

BROADLY speaking, the problem of silt movement is as old as the earth itself. It is caused by the gradual disintegration of the earth's surface through the action of wind, frost, rain, and other natural forces. It may, and often is, magnified by the actions or derelictions of man. Such influences and their results are here described, simply and clearly. In effect, the paper is a primer on this persistent problem that engages the best effort of engineers, a potent argument for utilizing modern advances in attacking an ancient difficulty.

IN recent years the subject of silt has been so widely discussed in popular and technical literature that many people have come to believe that the nation faces an insoluble problem. This is not so. Nevertheless, one of the major difficulties of irrigation farming in arid and semi-arid regions throughout the world is that of preventing silt from collecting in the ditches.

Scientists generally use the term "silt" in a strict sense to classify any soil having particles between 0.005 mm and 0.05 mm in diameter. Five hundred of the largest particles in this range, or five thousand of the smallest particles, if placed side by side, would be one inch long. In this article, however, the term is used in a broad sense to designate the usual material transported by wind or water, varying from minute particles of clay to larger particles of coarse sand.

If the material being transported by irrigation water in farm ditches is less than 0.0004 in. in size, it will not drop to the bed unless the water stops flowing or moves very slowly. Such material generally is carried through the entire length of an irrigation system, and eventually is deposited on the fields. Very fine sands are not carried by the water directly on to the lands but are deposited in the laterals and ditches. If not removed, the deposits soon reduce the capacity of the ditches and eventually may clog them entirely. Larger particles may be carried into the larger farm ditches, but as a rule are deposited in the main canals. Such deposits usually can only be removed by heavy and expensive equipment.

Among non-farmers the notion prevails that such material adds to the fertility of the soil and is highly beneficial. The idea is probably founded on accounts of certain rivers, such as the Nile. The Nile is however unusual. Floods originate in high altitudes near the Equator, and as they leave the mountains they pass through steaming, fermenting tropical swamps. Decaying organic matter picked up by the waters, constitutes a sizeable proportion of the total load.

In the arid and semi-arid regions of the United States the material transported is largely inorganic, and so does not help to nourish the fields on which it comes to rest. If it happens to be in the nature of clay, it is deposited as a thin layer. As this crust dries in the hot sun it bakes and cracks into small pieces, which curl upward at the edges. Frequently this action pulls up young plants, which are killed when their tender roots are exposed to the sun. Also it is difficult to cultivate a field covered with such a baked crust, as it disturbs the plants.

In very sandy soils a clay deposit may have some value in reducing the spaces between sand grains, thereby causing the soil to retain water for longer periods of time. If such spaces become entirely filled, however, necessary drainage is prevented. Sandy deposits, on the other hand, are eventually cultivated into the fields and may accelerate drainage to an undesirable degree.

Another condition which the irrigation farmer must overcome is the uneven building up of his fields at the edge where the water first runs on to the land, for it is here that a large part of the silt load comes to rest. This material must be worked toward the lower end of the field if water is to be uniformly delivered to the crops.

SILTING OF RESERVOIRS

Reservoirs supplying irrigation ditches serve to desilt the water before it enters the system. Those created by small dams in arid regions generally have a life of only a few years, after which the basin becomes filled with silt and the river thereafter carries its load through the "reservoir" into the irrigation system.

In designing large dams, the necessity of making provision for reservoir silting is now recognized. Dams are located and designed so as to create reservoirs with sufficient space at the bottom to accumulate silt for a great many years before operation is affected.

In the case of Lake Mead, largest man-made reservoir, it has been estimated that with upstream conditions unchanged, the efficiency will be affected, but not seriously, at the end of the first 100 years of operation. In 300 years the efficiency will be seriously affected. Long before that, however, additional upstream reservoirs will have been constructed with sufficient capacity to relieve Lake Mead of the major portion of the silt burden. This will extend the period of efficiency to at least 500 years. This period may be considerably lengthened if measures are taken to prevent erosion on the watershed. Under the Boulder Canyon Project Adjustment Act (54 Stat. 774), the cost of constructing the dam and power plant is to be repaid within 50 years.

The reservoir silting problem is thus recognized by the U.S. Department of Agriculture:

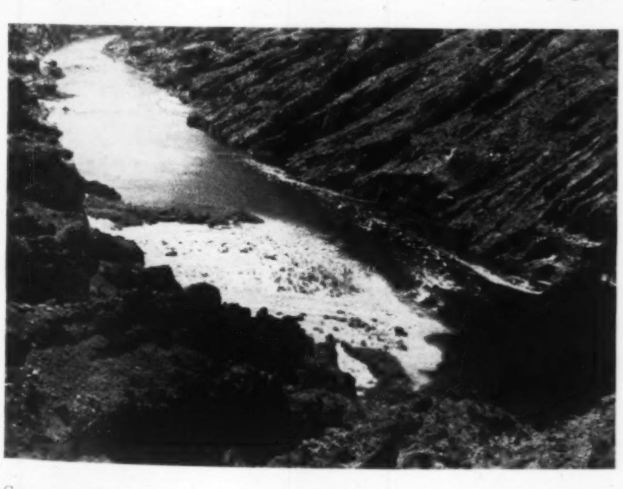
"There are more than 8,400 dams and reservoirs in the United States and a conservative estimate would place the additional investment in these at more than two billion dollars. At least one-fifth of the number, representing three-quarters of the total investment, depend solely upon storage for their usefulness, and when storage is gone as a result of silting, their value will have largely disappeared."

Since the larger particles carried in suspension by a stream begin to drop out when the stream runs into a reservoir or a natural widening where the velocity is diminished, a delta is soon built up. This causes the water to back up gradually for a considerable distance. It may overflow the banks, inundate areas which as a result may become swamps and, if the water eventually drains away, leave a deposit of silt on fertile valley lands.

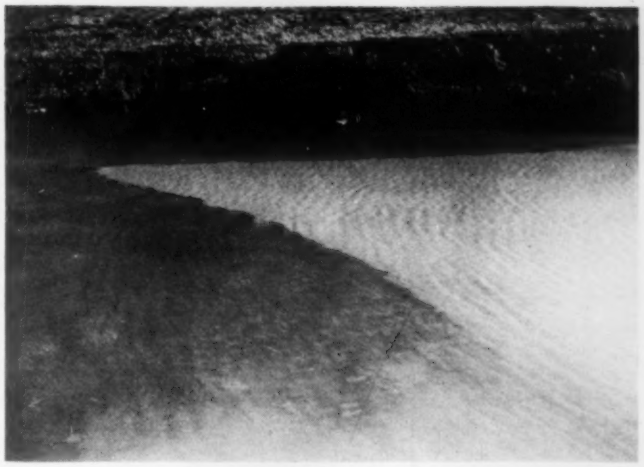
EFFECT OF SILT IN RIVERS AND HARBORS

If the water has been desilted to any extent in the reservoir, it may enter the river below the dam in a fairly clear state. It then immediately begins to pick up material from the river bed. If this continues for any length of time, the bed may eventually drop lower than the intake structures of canals which divert the water from the river.

Also, river channels are often blocked, not as the result of a dam, but because steep tributaries of the principal stream pour a huge quantity of material into the main channel faster than it can be carried away. Much debris which readily remains in suspension in the turbulent waters of steep tributaries cannot be moved even as bed load by the slower waters of the main channel. Consequently these deposits remain in place or move so slowly as bed load that a gradual building up of the bed results. Thus flood waters which would ordinarily pass down the main stream are forced over the banks, break levees, and cause enormous damage annually to highways, railroads, towns, and adjacent valley industries.



Channel Partially Blocked by Debris from a Tributary
Automobile on Upstream End of Wash, Appearing as Small Black Spot, Indicates Size of Deposit



Spearhead of Silty River Water Plunges Down and Under the Blue-Green Waters of Lake Mead at Its Upper End

Another phase of the problem accounts for the expenditure of millions of dollars annually throughout the world. This is shoaling in rivers and harbors, which would prevent navigation entirely if channels were not constantly dredged or channelization structures constructed. On the Ganges in India, deposits have accumulated to such an extent that the river now has several mouths, in each of which the main channel constantly changes.

In the Hooghly River, through which boats pass to Calcutta, the rate of channel change is so rapid that pilots trained to the work from childhood are allotted only a short stretch of river over which they may ply their trade. In this manner they become so familiar with a given stretch and the behavior of the deposits within that stretch that they can predict fairly accurately the movements of shoals and channels.

Air as well as water creates a silt problem. Strong winds carry away rich soils from farm land, and rich lands are frequently covered with deposits of inferior soil transported by the wind.

Damages from this silt movement, both air and water borne, are not confined to agriculture but extend to other forms of industry. Silt directly or indirectly costs the nation millions of dollars a year. If erosion takes place as the result of the forces of nature, it is referred to as the geological norm. If, on the other hand, the rate of erosion becomes excessive through the uses and works of man, it is referred to as accelerated erosion.

Normal erosion includes the movement of rock and soil from mountainous regions above timber line. Frost tends to crack and disintegrate, while wind and rain complete the action. In desert regions, however, normal erosion includes the movement of sand which is constantly being blown about, and during the infrequent rains, carried toward streams. Where vegetation is abundant, the soil is held in place by intricate root systems, often covered with a blanket of humus, leaves, and other matter.

This blanket absorbs water during rainstorms or periods of runoff during snow melt, and prevents the soil from being carried away. In drier seasons some of this water previously absorbed permeates downward to be added to the ground-water supply. The remaining water is evaporated or lost by transpiration—used by vegetation and later lost through the pores of leaves in the form of vapor. Thus opposing natural forces tend to prevent excessive erosion.

WAYS EROSION IS ACCELERATED BY MAN

Accelerated erosion, on the other hand, is started by man's interference with one or more of the natural forces, without providing compensating changes in certain other forces to maintain equilibrium. One of the chief causes has been uncontrolled commercial logging practices. Huge logs are dragged over the ground, crushing and uprooting small trees and shrubs and tearing the blanket covering the soil. With this protection removed, the full fury of driving rains and high winds is directed against the forest land. With no shade to retard the melting of snows, greater flows of water pass over the broken ground and soon erode channels that carry away huge quantities of material. The U.S. Forest Service has found that clear-cutting a forest area at Wagon Wheel Gap in the high mountains of Colorado increased the silt load $7^1/_2$ times.

Unchecked forest fires may cause even more damage than logging, because cut branches and underbrush, which retard runoff to some extent, may be consumed along with much of the litter, thereby completely exposing the area to the elements. Erosion would be classified as normal where the fires result from lightning, but in other instances, where they are started by the negligent practices of man, the resulting erosion is definitely of the accelerated type.

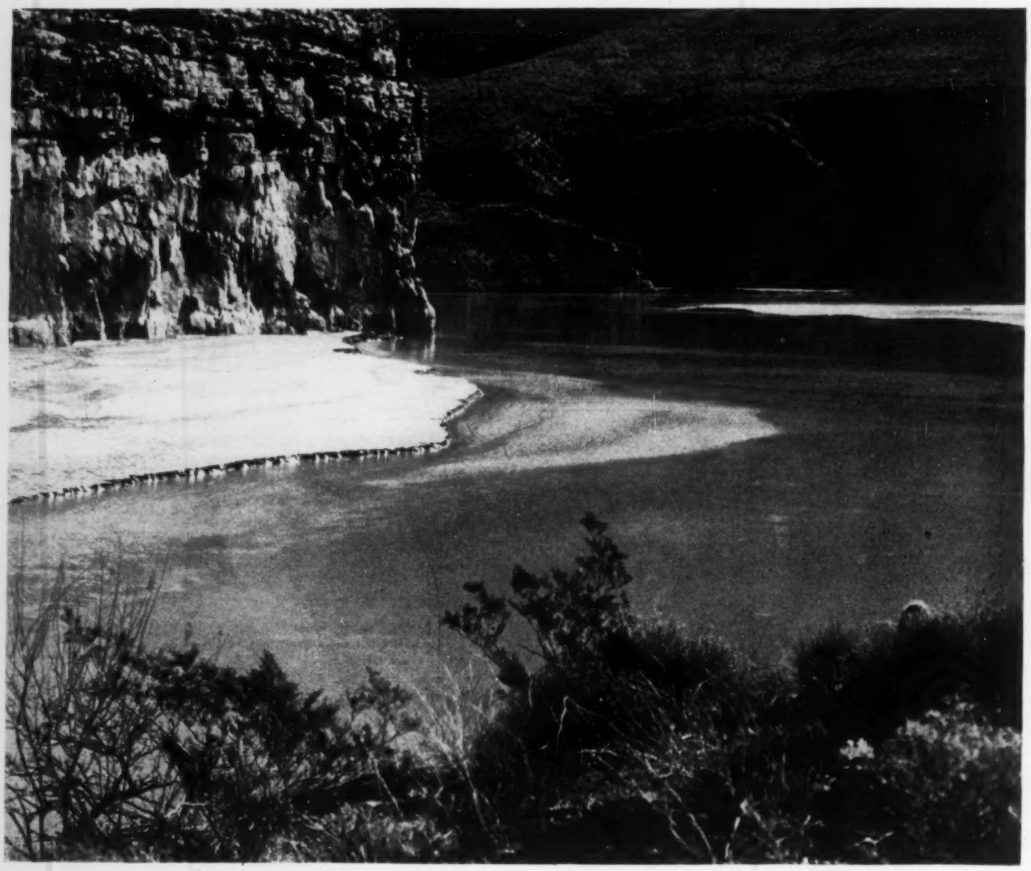
Overgrazing has been a major cause of accelerated erosion, particularly in the high open range country. In most instances the more abundant the natural growth, the heavier were the ranges stocked. This practice resulted in depletion of the natural cover, particularly in years of drought, making the soil less resistant to erosion. Where cattle trails developed, and the protective cover was broken, water running down the paths in many instances cut gullies of considerable size.

In some parts of the country fumes from industrial plants have killed all vegetation for several miles around. Faulty cropping practices include cultivating steep lands which should remain in timber or be used for noncultivated crops, over-cropping, and failure to rotate crops. Another cause of silt-laden streams is the practice of some mills of dumping tons of tailings into the streams for the specific purpose of having them carried away, giving no consideration to how this may affect the rights of other water users below.

While most of the soil carried away as a result of these erosional factors is fine, there have been instances where runoff from slopes denuded of timber moved boulders weighing over 600,000 lb.

Although the interrelated problems of siltation and erosion and their general causes were recognized by the early American colonists, the problem did not gain wide recognition until a series of droughts, beginning about 1930, caused thousands of acres of pasture and farm lands to dry out, killing vegetation. This was followed by dust storms which caused farmers to leave their homes and seek other sections where they could extract an existence from the soil. As they soon ran out of funds and became a burden to communities already overburdened, it was apparent that the Government must step in to save dying cattle and relieve destitution. Thereafter various governmental agencies set to work to alleviate these conditions. Much has been accomplished; more remains to be done.

In the past the silt problem has been treated locally. It was always realized that there were probably several forms of accelerated erosion in progress above the trouble zone, but little could be done by the injured parties to curb the faulty practices of many persons scattered over a huge watershed.



SILT BARS ARE BUILT UP IN BENDS AND COVES WHERE VELOCITY IS LOW

The desilting basin at Laguna Dam is an example of a local method of reducing the amount of silt carried into an irrigation system. A rectangular settling basin 116 ft wide, 800 ft long, and 18 ft deep, was provided. The water intended for irrigation approached the canal head at a velocity as low as 1 ft per sec, which caused the heavier particles to drop to the floor of the basin. About every three days it was necessary to raise the gates at one end of the basin to flush out these deposits, which were then carried back into the river below the dam.

About 5 miles above Laguna Dam at Imperial Dam, desilting works divert water into the All-American Canal. They are the most elaborate ever constructed. The plant was designed on the same principle employed in the Laguna basin, that the heavier particles will fall out of suspension if the velocity is sufficiently decreased. By innovations resulting from field observations, theoretical and laboratory studies, greater quantities of water are handled in shorter periods of time than in the ordinary settling basin. (See D. M. Forester, "Desilting Works for the All-American Canal," CIVIL ENGINEERING, October 1938, page 649.)

Most desilting basins rely for their efficiency on the same principle—that water brought to a complete halt will lose particles carried in suspension. This method is effective if the particles are large enough to drop out quickly, but with large quantities of fine material it may be impossible to hold the water long enough. In such instances chemicals such as sulfate of alumina or ferrous sulfate have been added to coagulate the suspended materials. Even when the chemicals are not harmful to crops, the expense of this method generally makes it impracticable.

Where the troublesome material moves along the bed in a small channel such as an irrigation ditch, sand traps have been found effective. These are box-like structures, open at the top and both ends, and constructed in the ditch so that water will flow through. A specially constructed floor causes the sand to move to one side of the box, where it drops into a trap from which it can be removed. In some instances the structure can be so arranged that the sand is carried away and deposited at some designated place.

A satisfactory means of keeping large channels open is to construct a series of walls or jetties extending from each shore at right angles to the current. As soon as the water on the downstream side of these jetties becomes comparatively still, the suspended load drops out. By properly spacing the jetties it is possible to build up deposits between them near the shores, and to prevent shoals from forming in the main channel.

STUDIES OF SILT PROBLEMS CONDUCTED BY GOVERNMENT AGENCIES

The Bureau of Reclamation has for many years collected data relating to silt sizes and total silt content in rivers and canals. Studies have likewise been made to determine the proper canal cross-section to prevent silting and scouring.

Since 1934, the Bureau and the Geological Survey have cooperated in studying the density currents in Lake Mead. It is expected that these studies will throw considerable light on the movement of silt-laden currents in reservoirs. It may become possible to route these currents through reservoirs, thereby adding considerably to the life span of such storage basins. Since the closure of Boulder Dam in 1935, the Bureau's studies of the degradation of the river bed below the dam have shown how the bed material behaves under the action of the water released from the dam. These studies will be of considerable value in designing future structures along the river.

For some time several federal agencies coping with problems in this field have made a thorough investigation of sediment in streams, in cooperation with the Iowa Institute of Hydraulic Research. Besides the Bureau, these agencies include the Corps of Engineers, the Geological Survey, the Office of Indian Affairs, the Flood Control Coordinating Committee of the Department of Agriculture, and the Tennessee Valley Authority.

These studies and the structures which result from them can, of course, only solve the silt problem in the localities concerned. This was the only logical approach, however, as the complete control of accelerated erosion is a problem of such magnitude that it must be done by a long-range program. Meanwhile present methods of control must be used and improved upon.

STREAM BED IN WHICH BOULDERS AND DEBRIS WERE DROPPED BY A FLASH FLOOD WHEN IT ENCOUNTERED THE QUIET WATERS OF A LAKE

Fortunately, a long-range program is well under way. Success will be guaranteed if there is cooperation among farmers, stockmen, lumbering and mining companies, and interested governmental agencies—supplemented by appropriate legislation.

First, the Bureau of Reclamation is now engaged in a soil and moisture conservation program in cooperation with other agencies of the Departments of the Interior and of Agriculture. At present these activities include the control of erosion on the beds of rivers, canals, and laterals through such practices as riprapping, lining, and realinement. Control of bank erosion along such waterways is maintained through seeding, planting of shrubs, and riprapping on banks and adjacent areas subject to erosion.

In addition, a program of education has been promulgated. This will bring to the attention of farmers, ranchers, and others the importance of using water economically and of properly distributing it to irrigated lands.

A third phase of the program has not yet developed to any great extent. It calls for the protection of lands which are not now under irrigation but which have been set aside on the Public Domain for future development under Reclamation withdrawal.

Through a soil conservation program, the Department of Agriculture is engaged in bringing to farmers information on erosion control by such practices as crop rotation, strip-cropping, winter-cover crops, and terracing Where lands are already badly eroded, small structures are being erected to check further erosion. The Forest Service, through a program of fire prevention and logging control, is protecting the present cover and helping in erosion control through the construction of check dams and by reforestation programs. Through such activities as range management, fire control, and reseeding of range lands, the Grazing Service of the Department of the Interior is also doing much to aid the conservation program.

While only the Federal Government can guide and control a long-range program of such magnitude, it must be stressed that in the last analysis it is the transgression of Nature's laws by individuals that can hinder and wreck the program. It remains the duty of every individual on every watershed to avoid those practices which accelerate erosion.

Repairing Damage from May 1942 Flood in Pennsylvania

By John L. Herber

District Engineer, Pennsylvania State Highway Department, Scranton, Pa.

In the glaciated areas of northeastern Pennsylvania, numerous small streams with steep gradients create a situation ideal for flash floods. When a widespread area receives a downpour, as was the case in May 1942, devastating floods result. Twenty-eight bridges and several miles of highway were literally washed away and highway departments were faced with the tremendous task of quickly restoring essential traffic arteries. Mr. Herber in this paper, presented originally before the Northeast Chapter of the Pennsylvania Society of Professional Engineers, describes the work involved in the speedy restoration of service.

In May 1942, a four-day rain in and around Wayne County, Pennsylvania, was so widespread that the accumulated waters rushing down the stream beds did damage estimated at more than a million and a half dollars. Destruction to highways and bridges was so extensive that the available men and equipment were inadequate to restore traffic immediately. Throughout the entire watershed of the Lackawaxen River excessive rainfall created the "rushing waters" which is the translation of this Indian name.

The official record of rainfall for the four-day storm is as follows:

Date	Scranton	Honesdale
May 20	0.60 in.	0.07 in.
May 21	1.45 in.	1.25 in.
May 22	2.67 in.	0.09 in.
May 23	0.02 in.	6.35 in.
Total	4.74 in.	7.76 in.

The unusual property damage and other losses suffered by those who could ill afford them, served to reemphasize the desirability of establishing homes in areas not usually subject to flood conditions. To public officials this flood has given eloquent evidence that stream channels, large or small, should be kept free from debris and obstructions to the waterway. Much of the property loss resulted from this cause. The obstructions were generally buildings, improperly located walls, or the foundations of buildings.

It is difficult to predict with accuracy the behavior of any stream in view of the many factors which cannot be determined. For example, at no time within record has the Lackawaxen River risen to such heights. The old Delaware and Hudson Canal towpath between Hawley and Lackawaxen, built about 1828 and protected from the river by heavy stone walls, was torn out in several places. This towpath had resisted all damage until this last flood, but it was unable to withstand the unprecedented rise of the river to 6 ft and at places 8 ft above that of any flood in the last 115 years.

Mass Concrete Pier for Steel-Beam Bridge Over Spring Brook Was Undermined and Displaced

Steel Bridge Will Be Salvaged Intact

In the flood area, which included portions of Luzerne, Pike, and Lackawanna counties and all of Wayne County, several sections of improved highway were completely destroyed. These sections were comparatively short but when added together they totaled $2^1/_2$ miles. In Wayne and Pike counties approximately $9^3/_4$ miles of unimproved state highways were also destroyed. The total destruction of state highways, most of which involved the loss of heavy fills, was about 12 miles.

A summary of the estimated damage to the roads, improved and unimproved, by counties, follows:

County	Roadway Damage
Bradford	$ 2,100
Lackawanna	53,725
Luzerne	19,005
Pike	51,050
Susquehanna	10,275
Wayne	141,300
Total for district	$277,455

The loss due to bridges that were damaged but not destroyed by this flood has been carefully studied and can be very closely estimated, as follows:

County	Bridge Damage
Lackawanna	$ 1,400
Luzerne	19,500
Susquehanna	1,850
Wayne	51,860
Total for district	$74,610

Damage resulting in the total destruction of bridges and their approaches, the largest item of all, may be summarized as follows:

County	No. Bridges Destroyed	Bridge Losses	Losses Due to Destroyed Approaches	Total
Lackawanna	3	*$205,000	$123,000	$328,000
Luzerne	2	20,000	20,000	40,000
Wayne	23	563,000	275,000	838,000
Total for district				$1,206,000

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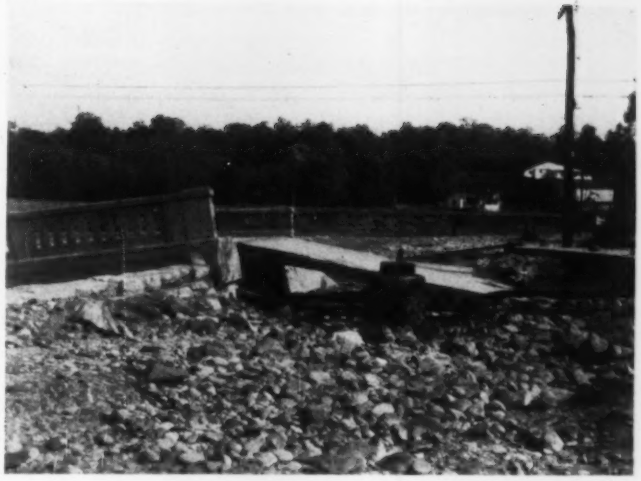
* This includes an expenditure of $110,000 required for a new underpass under the Erie Railroad on the Moosic-Daleville Highway. As the flood demonstrated that the highway bridge over Spring Brook near this site cannot be safely maintained in its present location, it will be necessary to relocate the highway, and therefore to build this underpass.

Stream channels at the sites of surviving or destroyed bridges have been greatly changed in many instances by the deposited debris. To protect our highways, a large volume of channel cleaning must be undertaken as a part of the restoration program. In some instances creeks have left their former channels and have opened up new courses, which will endanger the highway until such time as these streams can be confined to their former courses.

There are several locations, particularly in Wayne County, where existing channels closely paralleling highways must be widened and deepened and the roadway further protected by means of dikes. The cost of all this excavation will be about $125,000. A conservative estimate would place the total loss, including bridges, in the neighborhood of $1,683,000.

THE PROBLEM OF RESTORATION

Normally, a construction project involving an expenditure of $1,683,000 can be very readily handled. But the problem of restoration in this case is vastly different. A glance at the map of Wayne County, depicting the widespread damage, shows the necessity of setting up separately organized repair crews. We all know that heavy equipment is scarce because of the war situation. The same is true of labor and supervision. When 23 bridges have been completely washed away on a state highway system, scattered over a whole county, the demands that come in for quick action from each of the 23 localities can well be imagined. Each of the replacement jobs created a problem of organization and equipment nearly as difficult as that for a million-dollar contract in normal times. To handle the work, therefore, several organizations had to cooperate. The Wayne County maintenance organization was expanded with additional men, supervisory personnel, and equipment, and confined its operations to the central and eastern parts of the county. The State Highway maintenance organization of Susquehanna County moved into northern Wayne County to undertake the problem of highway and bridge restoration and channel cleaning there. At the same time the Lackawanna County maintenance organization moved its personnel and equipment into the southwestern part of Wayne County. The Lackawanna County organization also repaired the bridge at Hoadleys, thereby making it possible to reach Honesdale from the south. This route will serve also as an approach to Honesdale for through east and west traffic until the Roosevelt Highway across the county can be reopened.



Concrete Bridge Over Spring Brook on Route 439 Destroyed When Pier Was Undermined and Approach Washed Out

Two reinforced concrete bridges on the Moosic-Daleville highway were completely destroyed. Plans for the reconstruction of one have been completed and it is expected that by salvaging steel from local sources the work can be started at a very early date. To relocate the highway away from the hazards of Spring Brook it will be necessary to lift one slightly damaged 2-span heavy plate-girder bridge from its present position and move it bodily about 700 ft onto new foundations. This entire roadway and bridge improvement is planned for completion before winter sets in.

Of the 23 bridges totally destroyed in Wayne County, 16 had a span of from 60 to 180 ft. The problem of restoring these bridges under present conditions is no easy one in view of the necessity of priorities and the difficulty in obtaining them. As a consequence, four bridges on the Roosevelt Highway—one at Prompton, two at Honesdale, and one at Hawley—are being temporarily built with timber piling, and oak stringers and floor systems. These bridges have a 24-ft roadway and sidewalks where they are considered necessary.

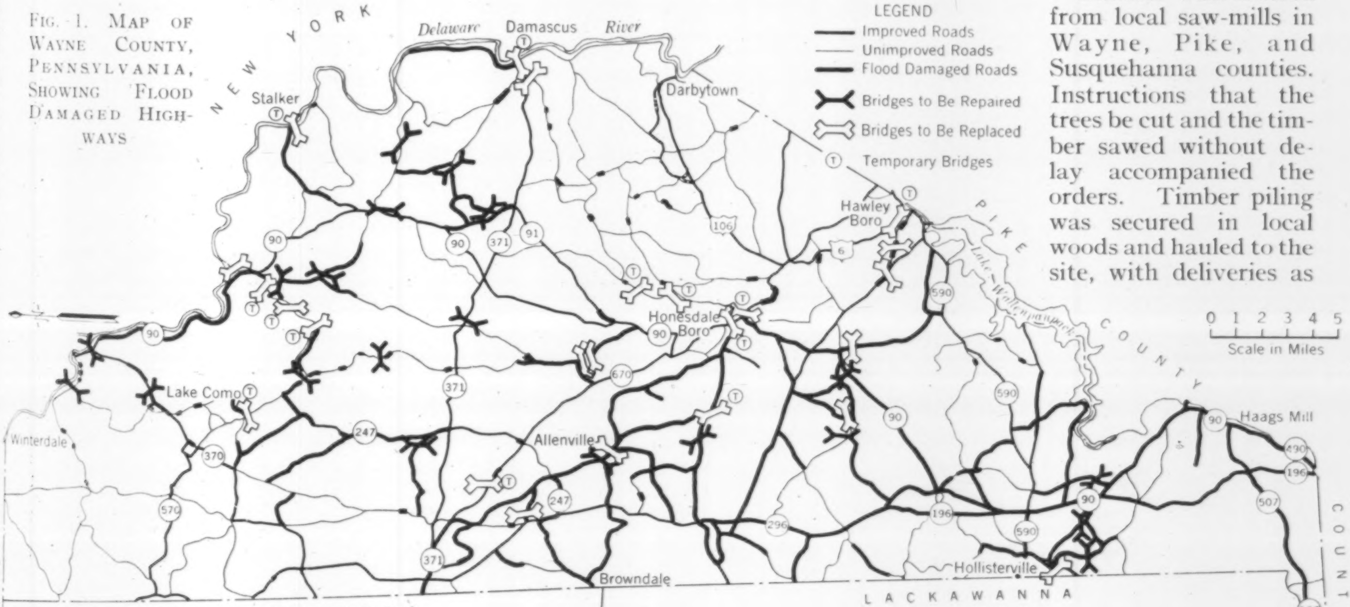
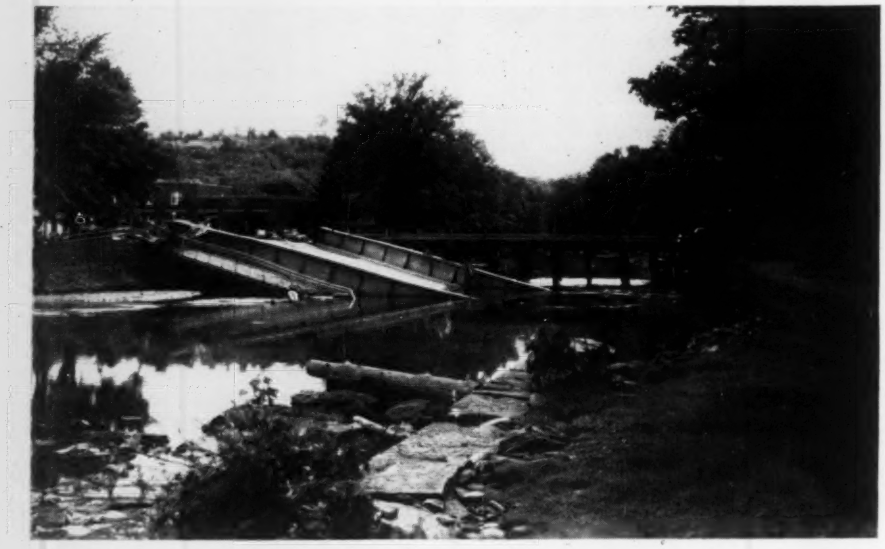


Fig. 1. Map of Wayne County, Pennsylvania, Showing Flood Damaged Highways

LEGEND
Improved Roads
Unimproved Roads
Flood Damaged Roads
Bridges to Be Repaired
Bridges to Be Replaced
Ⓣ Temporary Bridges
NEW YORK
Delaware
Damascus
River
Stalker
Darbytown
Hawley Boro
PIKE COUNTY
Lake Wallenpaupack
Honesdale Boro
Lake Como
Winterdale
Allenville
Browndale
Hollisterville
Haags Mill
SUSQUEHANNA COUNTY
LACKAWANNA COUNTY
MONROE COUNTY
0 1 2 3 4 5
Scale in Miles
90
371
91
106
6
590
670
247
370
570
296
196
507
490

Lumber was ordered from local saw-mills in Wayne, Pike, and Susquehanna counties. Instructions that the trees be cut and the timber sawed without delay accompanied the orders. Timber piling was secured in local woods and hauled to the site, with deliveries as early as four days after the placing of the order. Because of the rainy conditions following the storm and the difficulty of hauling through woods and fields, temporary bridge building was delayed. Bolts necessary to tie the piles together, to brace the bents, and to secure the floor systems were manufactured locally as required from material in stock, since it was impossible to secure priorities quickly enough to order bolts elsewhere.



WASHED-OUT ABUTMENT ALLOWED 90-FT PLATE-GIRDER BRIDGE AT HONESDALE TO DROP INTO LACKAWAXEN RIVER

DAMAGE TO ROOSEVELT HIGHWAY

Perhaps the Roosevelt Highway through Wayne County suffered the most of any important route. To restore service on this main artery, three pile-driving outfits were pieced together from the equipment obtained in adjacent counties—some in Harrisburg and some in New York State. The piling for the bridge on the Main Street in Honesdale was driven complete on June 5, thirteen days after the flood, but because of difficulty in securing lumber, the bridge deck was not completed and ready for traffic until June 11. The piling for the temporary bridge at Prompton was completed on June 15, and the bridge was opened to traffic on June 20. The piling for the structure at Hawley, across the Lackawaxen River, was completed on June 18 and opened to traffic by the night of June 22. All these bridges have total spans varying from 90 to 130 ft. The last temporary bridge on this highway at lower Honesdale was started June 17. This was the least urgent of the four, inasmuch as there was a way around town which gave access to all parts of Honesdale. All temporary bridges were located where they would not interfere with the placing of the permanent structures.

Necessarily, wooden bridges of this type had to be built on pile foundations. Timber bents in the stream channel are recognized to be hazardous and unsatisfactory. However, the Department was faced with the choice of providing for a temporary structure of this kind or depriving the public of the use of the highway. The emergency demanded action and all agencies of the state government concerned with this matter agreed that this type of structure should be used until such time as the permanent ones could be built.

In Honesdale and Hawley, portions of the boroughs were isolated when the flood receded, and pedestrians had to cross the Lackawaxen in boats. To relieve this condition a footbridge 116 ft long was built across the river two days after the flood. Another bridge, to connect East Honesdale with the business district of the town, was erected across the same stream four days later. The length of this structure was 133 ft. At Hawley a footbridge across the river was begun at 3:00 a.m. on May 30 and in use at 3:00 p.m. of the same day. This bridge was also 133 ft long. The emergency condition facing the citizens of these communities, who were out of food and other necessary supplies, warranted the building of these three footbridges.

While the work of restoring the highways for public use has been under way, engineering parties have been at work surveying proposed sites for new bridges to replace the temporary structures. Surveys have also been under way to determine the possibility of relocating several portions of our state highways, eliminating some bridges and relocating others. Furthermore, surveys of stream channels have been rushed preliminary to their relocation.

Additional draftsmen were recruited from other district organizations in the state to assist in compiling the survey data and drainage information on which could be based conservative engineering designs for the permanent structures. Plans are also being prepared for these proposed structures, some of which may be built by the maintenance organizations but most of which will undoubtedly be constructed under contract.

After the type of a permanent structure was chosen, it was necessary to locate sufficient steel of the proper dimensions that might be re-used. An example is the bridge to be replaced on Route 590 between Elmhurst and Hollisterville, which will be rebuilt with abutments of slightly greater span than those of the old structure. A steel bridge of adequate roadway width now in Schuylkill County is being dismantled and will be assembled on the new abutments.

Another example of such a bridge is the steel truss carried away from its foundations at Fourth Street, Honesdale, and landed in the stream bed only slightly damaged. This has now been dismantled, piece by piece, and the parts numbered, so that it can be reassembled on new foundations at Tanners Falls, about six miles north of Honesdale. I-beams at points as far away as New York City were located. Once the steel is collected, the contract can be let for the fabricating or assembling of the bridge.

At the moment it seems impossible to secure sufficient steel for one or two of the more important bridges on the Roosevelt Highway at Honesdale. All the more important structures should be contracted for at a sufficiently early date to permit their completion before winter. It might be serious indeed if the timber bents were left in the stream channels over the winter, for the ice and high water may sweep them away next spring. Everything possible is being done to avoid this possibility.

In the most critical areas, where the stream bed has been strewn with debris and where a modest freshet might pick it up and lodge it against a temporary bridge, power shovels have cleaned the old channel within a reasonable distance of the structure to minimize the interference with the stream. In one case such debris was hauled to a fill for a bridge approach.

A contractor's organization has been dismantling the heavy 90-ft plate-girder bridge which was swept from its foundations on upper Main Street in Honesdale, landing in the bed of the Lackawaxen River. (See an accompanying photograph.) The steel truss carrying Roosevelt Highway traffic at lower Honesdale is also being dismantled and removed as an obstruction to the stream at this location. The 129-ft steel span which was swept away at Hawley landed in the stream several hundred feet from the original site in a badly distorted and broken condition. When cut up, it will be disposed of as scrap.

By June 17, twenty days after flood waters receded, repairs to roadways, including restoring washouts, opening ditches, and replacing smaller cross drains on approximately 75 miles of road in the flood zone were completed. Approximately 140,000 cu yd of excavated material was moved. The cost of this work up to June 17 was $98,500. Nearly 500 men, 60 trucks, 10 power shovels, 5 heavy graders, 5 tractors and bulldozers, and one 15-cu yd scraper were put to work on the permanent and temporary restoration of essential highways.

LESSONS LEARNED FROM THE FLOOD

This flood, though disastrous, taught several important lessons. Waterway areas at bridge sites in the hilly parts of northeastern Pennsylvania should be designed to carry maximum flood volume. To avoid damage to the approaching roadway, stream channels should be straight through the abutments. Channel widening and cleaning must be studied and kept up to date in the vicinity of the highways. Everything should be done to encourage the public to keep the stream channels free from all encroachments and obstructions which might increase the danger during flood stages.

Reinforced-Concrete Pavement Slabs Carried Along by Spring Brook

Note Water Main Exposed at Right

Concrete decks or steel-span structures may be submerged in strong currents and still survive if the foundations remain secure and the superstructures are not struck by heavy debris. Outstanding examples of this were the concrete bridge at Bear Creek, Luzerne County, and the steel truss over Dyberry Creek at upper Honesdale. At certain locations it may be well to design for unusual flood stages by depressing the roadway approaches so that the stream can flow over them, provided the berms and slopes of the roadway are properly protected with a paving which will withstand erosion.

Many wooden structures serving as dams in the hilly areas, and impounding sizable quantities of water, should be given rigid inspection. In many other cases, smaller dams not designed as permanent structures were washed away, releasing huge quantities of water, which increased the damage in the lower watershed areas.

Engineers' Notebook

Ingenious Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Direct Computations for the Sidesway of Bents

By Adolph Barjansky

Engineer, The Brush Development Company, Cleveland, Ohio

It has appropriately been said that the moment distribution method for solving indeterminate structures, introduced by Prof. Hardy Cross in 1932, revolutionized the technique of indeterminate analysis. There are, however, limits to the range of efficient application of moment distribution, beyond which some other approach becomes more advantageous.

The purpose of the present article is to illustrate this opinion by an example familiar to most structural designers—the computation of moments due to sidesway in simple bents. These moments are at present computed by some sequence of steps similar to the following:

1. The bending moments due to the applied loading are computed by moment distribution.
2. The shears and reactions caused by the moments determined in Step 1 are obtained from statics. Except for the case of complete symmetry (both structure and loading) it will be found that the laws of statics are not satisfied, as there remains an unbalanced horizontal force P, acting on the horizontal member of the bent (Fig. 1). This force P has to be counteracted from the outside. Thus in rigid-frame bridges, the backfill or the approach slab will exert the reaction necessary to restore equilibrium. In the absence of such supporting members, however, the bent moves laterally until the moments are so modified that P becomes zero. This action is known as sidesway, and its net effect is to change the moments as found in Step 1. To evaluate the amounts by which the first set of moments are changed, further steps are taken as follows:
3. A unit sidesway deformation is applied to the structure in the absence of any other loading, and resulting moments are again computed by moment distribution.

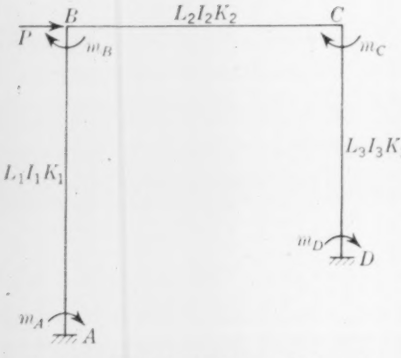


FIG. 1. SIDESWAY FORCE P ACTING ON A SIMPLE BENT

4. Shears and reactions due to the unit sidesway moments are computed as in Step 2, and another unbalanced force, the unit unbalanced force p, is obtained.

5. The unit sidesway moments found in Step 3 are multiplied in the ratio P/p, thus yielding actual sidesway moments.

6. These actual sidesway moments are now combined with the direct moments found in Step 1 to give the total moments under sidesway conditions.

The long and somewhat clumsy procedure described could, in this writer's opinion, be advantageously modified by getting rid of one of the two moment distributions (Steps 1 and 3). The variety of conditions found in practice as regards details of construction and even more so of loading, appears to justify the first of these distributions. The second, however, that of Step 3, refers to a very special type of loading, a horizontal force acting on the horizontal member of the bent, and could therefore be easily and conveniently replaced by the application of a formula, or better still, by reference to a set of curves prepared in advance.

The moments produced in a built-in bent by a force acting like P in Fig. 1 can be evaluated by formulas published in different works on structures. Very convenient ones, obtained by means of the slope-deflection equations, can be found in *Stresses in Framed Structures*, by G. A. Hool and W. S. Kinne, Appendix A, Table 56, page 571. After a slight change in notation to conform with present-day practice, these formulas become:

$$m_A = PL_1 \times \frac{k_3(3k_1k_3 + 4k_1 + qk_1 + 2k_3 + 2)}{2[k_1k_3(4 + 3q + 4q^2) + k_3(k_3 + 1) + q^2k_1(k_1 + 1) + 3k_1k_3(q^2k_1 + k_3)]} \quad \ldots\ldots(1)$$

$$m_B = PL_1 \times \frac{k_1k_3(3k_3 + 4 + 2q)}{2[k_1k_3(4 + 3q + 4q^2) + k_3(k_3 + 1) + q^2k_1(k_1 + 1) + 3k_1k_3(q^2k_1 + k_3)]} \quad \ldots\ldots(2)$$

Here m_A and m_B are the moments due to sidesway at points A and B of member AB, that is, what has been called actual sidesway moments in Steps 5 and 6. Both moments are positive according to the moment distribution sign convention. The quantities k_1 and k_3 are the relative distribution factors of the bent, $k_1 = \frac{K_2}{K_1}$, $k_3 = \frac{K_2}{K_3}$. The terms K_1, K_2, and K_3 are the distribution factors, $K_1 = \frac{I_1}{L_1}$, etc.; and q is the ratio of the lengths of the vertical members, $q = \frac{L_1}{L_3}$. To get the moments at points C and D, it is sufficient to use the formulas for points B and A, respectively, after introducing the following substitutions: k_3 for k_1, k_1 for k_3, L_3 for L_1, $\frac{1}{q}$ solidus for q.

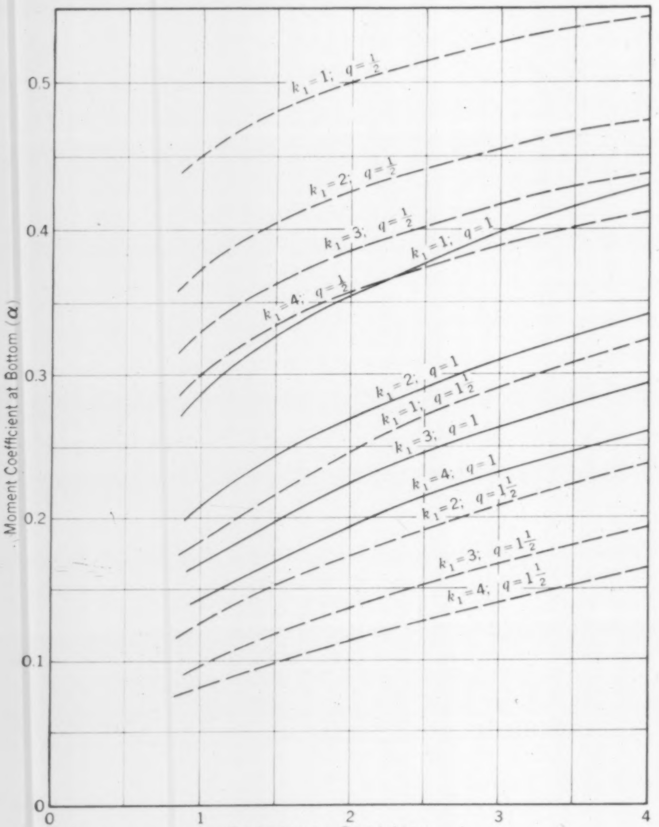


FIG. 2. CURVES FOR α VALUES

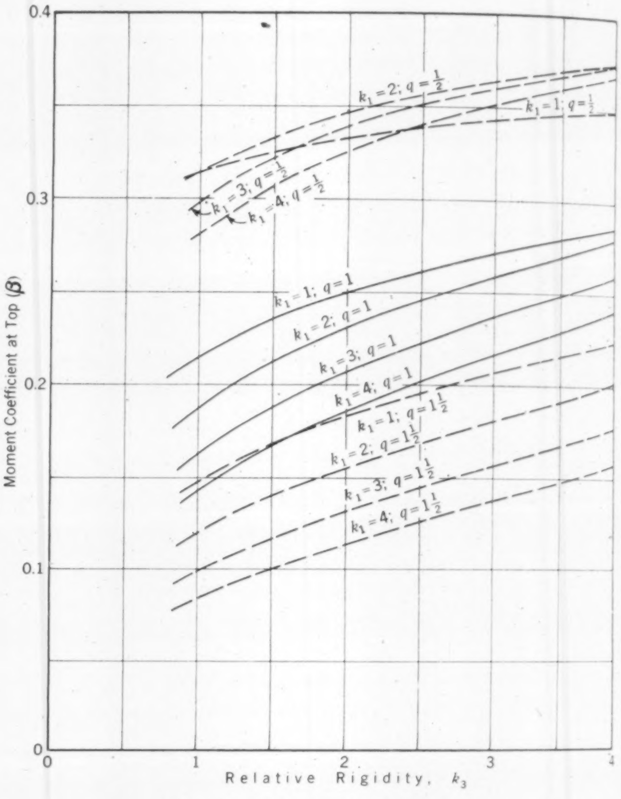


FIG. 3. CURVES FOR β VALUES

Equations 1 and 2 can be rewritten:

$$m_A = \alpha PL_1 \quad \ldots\ldots\ldots\ldots(3)$$

$$m_B = \beta PL_1 \quad \ldots\ldots\ldots\ldots(4)$$

with

$$\alpha = \frac{k_3(k_3(3k_1k_3 + 4k_1 + qk_1 + 2k_3 + 2)}{2[k_1k_3(4 + 3q + 4q^2) + k_3(k_3 + 1) + q^2k_1(k_1 + 1) + 3k_1k_3(q^2k_1 + k_3)]} \quad \ldots\ldots(5)$$

$$\beta = \frac{k_1k_3(3k_3 + 4 + 2q)}{2[k_1k_3(4 + 3q + 4q^2) + k_3(k_3 + 1) + q^2k_1(k_1 + 1) + 3k_1k_3(q^2k_1 + k_3)]} \quad \ldots\ldots(6)$$

The factors α and β are plotted in Figs. 2 and 3 for different values of the parameters k_1, k_3, and q.

Example. As an easy illustration of the application of these curves, consider the bent discussed in L. E. Grinter's *Theory of Modern Steel Structures*, Vol. II, page 153. Here $P = 477$ lb, $L_1 = L_3 = 20$ ft, and $q = 1$.

For the left leg: $k_1 = 12/3 = 4$; $k_3 = 12/6 = 2$, $\alpha = 0.194$, $\beta = 0.186$.

Moment at bottom: $PL_1\alpha = 477 \times 20 \times 0.194 = 1{,}850$ ft-lb (Grinter has 1,860 ft-lb)

Moment at top: $PL_1\beta = 477 \times 20 \times 0.186 = 1{,}775$ ft-lb (Grinter has 1,790 ft-lb)

For the right leg: $k_1 = 12/6 = 2$; $k_3 = 12/3 = 4$, $\alpha = 0.341$, $\beta = 0.279$.

Moment at bottom: $PL_3\alpha = 477 \times 20 \times 0.341 = 3{,}250$ ft-lb (Grinter has 3,230 ft-lb)

Moment at top: $PL_3\beta = 477 \times 20 \times 0.279 = 2{,}660$ ft-lb (Grinter has 2,660 ft-lb)

This example proves that sidesway moments can be quickly obtained by means of the curves presented and without the need of a second moment distribution. Thus the α and β values, obtained either from curves similar to those in Figs. 2 and 3, or from Eqs. 5 and 6, could advantageously be used either for the actual computation of sidesway moments or as a check on the results of he second moment distribution.

It would have been possible to go even further. Especially in the case of purely vertical loads, additional simplifications could easily have been introduced. Thus the computation of the unbalanced horizontal force P might have been dispensed with, and the corrections caused by sidesway to the moments resulting from the first distribution might have been obtained directly in terms of the four bent coefficients (one α and one β for each leg). However the writer has preferred to omit these developments for the following reasons:

1. They would somewhat restrict the very broad application of the method described.
2. They would tend to make the problem more abstract by concealing the true magnitude of some of the effects involved.

It is believed that the formulas and curves presented make possible an important simplification in the analysis of the effect of sidesway on simple bents. The method is perfectly general in that it does not limit in any way the type of bent to which it can be applied.

Relationship Between Bending Moments in Columns and Beams

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It is possible to obtain a generalized solution for the column subjected to both axial and arbitrary transverse loads in terms of the bending moment in a beam subjected to transverse loads only. A solution in this form simplifies analysis and gives interesting results.

The differential equation of the elastic line is

$$\frac{d^2y}{dx^2} = \frac{M}{EI} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

If E and I are constants, and if M, the bending moment, varies as some function of x and y, then Eq. 1 can be expressed generally for columns in the form

$$\frac{d^2y}{dx^2} + k^2y = m(x), \; (0 \leq X \leq l) \quad \ldots\ldots\ldots(2)$$

where $k^2 = P/EI$, and $m(x)$ is the bending moment due to transverse loads only. Because $M(x)$ has this fundamental property, it will now be shown that the bending moment in the column can be expressed in terms of the moment in the beam without axial loads. To demonstrate this property between beams and columns, it is necessary to write the solution to Eq. 2 in the following manner, where $y(x)$ is the deflection at any point x:

$$y(x) = A \cos kx + B \sin kx + \frac{1}{k}\int_0^x m(x') \sin k(x - x')dx' \quad \ldots\ldots(3)$$

This equation can be verified by substitution in Eq. 2. Here A and B are arbitrary constants to be determined from the boundary conditions. To make them more specific, take the case of columns most frequently encountered, simply supported at both ends, that is, when both x and y equal zero; and when $x = l$, $y = 0$. That is,

$$\left.\begin{aligned} y(0) &= 0 \\ y(l) &= 0 \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

With the use of these conditions, Eq. 3 becomes

$$y(x) = -\frac{\sin kx}{\sin kl}\int_0^l m(x') \sin k(l - x')dx' + \frac{1}{k}\int_0^x m(x') \sin k(x - x')dx' \quad \ldots(5)$$

From Eq. 5 it is clear that the deflection is expressed in terms of $m(x')$, the bending moment in a beam without axial loads. Differentiating Eq. 5 and substituting $x = 0$, the slope at the left end is expressed as

$$\left(\frac{dy}{dx}\right)_{x=0} = \theta_{x=0} = -\frac{1}{\sin kl}\int_0^l m(x') \sin k(l - x')\,dx' \quad \ldots\ldots(6)$$

The application of Eq. 6 will be shown in the illustrations that follow. Differentiating Eq. 5 twice, we obtain the bending moment in the column in terms of $m(x')$:

$$\frac{d^2y}{dx^2} = \frac{k \sin kx}{\sin kl}\int_0^l m(x') \sin k(l - x')dx' - k\int_0^x m(x') \sin k(x - x')dx' - m(x) \quad \ldots\ldots(7)$$

and the bending moment in the column is computed from $M(x) = EI\frac{d^2y}{dx^2}$. It is now evident that computing the bending moment in a column is a process of integration, to be performed either graphically or analytically. The significance of Eq. 7 can be shown graphically. Let us assume that the bending moment $m(x)$ can be represented as in Fig. 1. We note from the integrands of Eq. 7 that $m(x)dx$ is multiplied by $\sin k(l - x')$ and $\sin k(x - x')$, respectively, which corresponds to the order of moment in statics and strength of materials, but which is in our case the "sine order" moment. The order of "sine order" moment is infinite, as can be seen by expansion in series, and therefore is more complex than the first or second-order moment found in beam deflections and centroids. Two applications of Eq. 6 and Eq. 7 will now be shown.

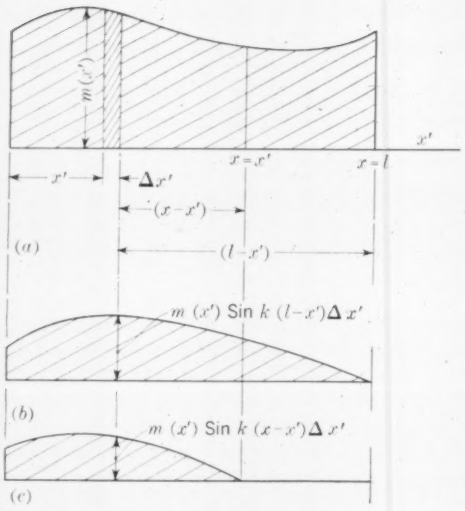

FIG. 1. BENDING MOMENT

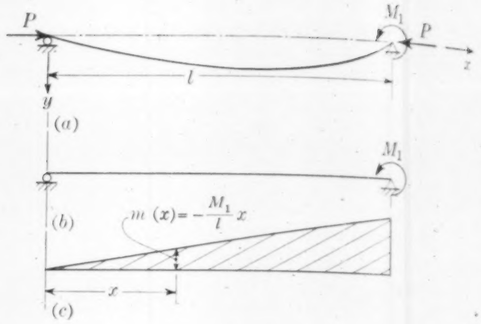

FIG. 2. CASE 1

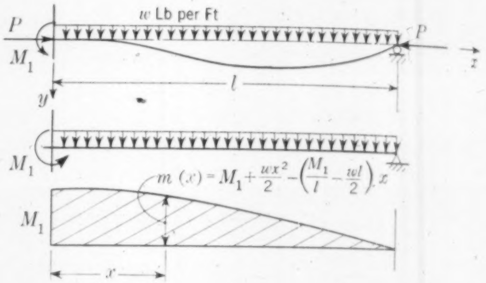

FIG. 3. CASE II

Case I. See Fig. 2, a column subjected to axial compressive loads P and a couple M_1. At the right end, $x = l$. In Fig. 2 (*b*) construct beam without axial loads and in Fig. 2 (*c*) the bending moment corresponding to Fig. 2 (*b*). Then substituting in Eq. 7 for $m(x') = -\frac{M_1}{l}x'(0 \leq x \leq l)$, we get the following for the bending moment in the column:

$$M(x) = M_1\left(\frac{\sin kx}{\sin kl}\right)$$

Equation 6 will give the slope at the left end:

$$\theta_{x=0} = \frac{M_1}{P}\left(\frac{k}{\sin kl} - \frac{1}{l}\right)$$

Case II. See Fig. 3, a column with one end fixed, the other supported, the column being subjected to axial compression and uniform transverse load. Then it can be seen that

$$m(x) = M_1 + \frac{wx^2}{2} - \left(\frac{M_1}{l} - \frac{wl}{2}\right)x \qquad 0 \leq x \leq l$$

But $\theta_{x=0} = 0$, so that, by substituting in Eq. 6 and integrating, we get

$$M_1 = -\frac{wl}{k}\left[\frac{\left(\tan\frac{kl}{2} - \frac{kl}{2}\right)\tan kl}{\tan kl - k}\right]$$

which can now be used in Eq. 7 to get $M(x)$. These two cases are typical of the ease with which numerous problems can be solved or checked by this method.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Sanitary Land Fills Practical Today

DEAR SIR: The article by Messrs. Eliassen and Lizee on "Sanitary Land Fills in New York City," in the September number of CIVIL ENGINEERING, is a working out on a large scale of the 1939 report of the Parran Committee, and seems thoroughly to vindicate that report. It is especially useful at this time when priorities prevent the extension of incineration and other disposal methods. The cost tabulation agrees with the writer's experience: that sanitary filling is the cheapest disposal method available.

It is fortunate that the authors give engineering direction to disposal of garbage by burial. In western Pennsylvania it is probable that garbage burial in some form or other is practiced more generally than any other form of disposal. At times the practice has doubtless produced odors, rodents, stagnant water, and other unsanitary conditions, but these conditions have been the result of careless, inefficient methods. Engineering skill and direction are required in garbage filling as well as in operating an incinerator. Now that we have the experience with land fills in New York, cited by the authors, to supplement the experiences of fifty years in Seattle (*Engineering News-Record*, August 3, 1939), San Francisco (CIVIL ENGINEERING, October 1939), and other cities, it seems to the writer that our profession has a distinct duty to perform. We should combat the popular, almost universal, prejudice against this method of disposal, and insist that it should be considered as a valid, useful, and sanitary method which, if properly conducted, would prove advantageous to many communities.

The authors do not seem to stress sufficiently the improved land conditions brought about by such fill. What can be more detrimental to a community than areas of rat- and mosquito-infested marshes? Surely the substitution of leveled areas, above tide, produces useful values to a community.

The writer is convinced that a similar benefit could be derived in many communities in western Pennsylvania. In many areas beds of bituminous coal have been uncovered by stripping the overburden and depositing it in huge unsightly mounds, 40 ft or more in height. The material excavated is generally incombustible and is loosely piled adjacent to the coal bed. Such procedure absolutely destroys the use of the property for any agricultural purpose. The adoption of methods similar to those practiced in New York would, in the writer's opinion, restore many such areas to useful community development. The sanitary filling of the garbage should produce sufficient revenue to pay the costs of leveling the unsightly mounds previously mentioned.

In regard to the details of operation—a definite filling plan should be prepared and followed, the fills being staked in the same manner as other engineering fills are staked. The necessity of prompt covering should be emphasized. Equipment will break down and, in most cases, some duplicate units should be provided for such an emergency.

The writer has had no experience with 20-ft fills as practiced by the authors. Perhaps in order to establish sanitary land fills in new localities it might prove advisable to limit the depth of fill to 5 ft, and gradually increase it as experience warrants.

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Heavy Construction Experience Vital

To the Editor: The publicity being given to Henry J. Kaiser undoubtedly exceeds the publicity ever given to any other contractor. This is due to peculiar and specific reasons: Mr. Kaiser has made a spectacular showing in a field entirely foreign to his regular business, which is contracting in the heavy construction field, in an activity vital to the war effort—shipbuilding. Now, he startles the nation by saying that he can build larger cargo planes than have ever been built and in less time, and planes also are vital to the war effort. Owing to a combination of peculiar facts and to proved outstanding performance, Mr. Kaiser could not avert publicity. But such accomplishment is more than a one-man job. Work well done, however, satisfies most doers.

Undoubtedly, what enables Kaiser and his associates to do such spectacular work in shipbuilding, and will surely help them in plane building, is their experience gained in the heavy construction field. Construction men go into isolated places, far from supplies and materials and, starting from scratch, build great structures—the Boulder, Grand Coulee, and Shasta dams; tunnels and bridges; channels in rivers and intracoastal waters remote from civilization. Such work requires organizing ability of high order and a knowledge of how to cope with new difficulties at the rising of every sun. Machinery breakdowns, floods, subzero temperatures, shortage of men, getting materials to the site, to say nothing of working out plans to build the structure quickly and economically—these are only a few of the problems involved.

When a contractor undertakes a big job, he doesn't walk into a luxurious office all ready for him, nor does he find an efficient smooth-working organization at his immediate command. Every time he signs a contract, he must start from scratch and quickly build an organization to fit a certain situation. His work varies constantly. New difficulties constantly confront him. He must ever work out new methods. His mistakes must be few, lest he go bankrupt or suffer the loss of a hard-earned reputation. He must keep to schedule, lest a bitter winter, a river in flood, or some other immutable circumstance engulf him.

The rapid execution of war work depends largely upon construction. Before the planes and the tanks there must be factories; before the ships, the yards; before planes in action, the bases and fields. Amazing records have been made by construction men: Cantonments, air fields, naval bases, dry docks, plane factories, and other vital installations have been made ready in fantastic time. Aladdin and his lamp have almost been outdone. Construction done under unprecedented difficulties at Newfoundland, Bermuda, points along the Atlantic coast, at such remote places as Iceland, Trinidad, Dutch Guiana, the Caribbean islands, and the far-flung islands of the Pacific will be an enduring monument to the genius and resourcefulness of American contractors. The nation owes them much. Working with the War and Navy departments, the work has been done with no scandal, little squabbling, and no exorbitant profits. Here, we find genuine patriotism, too; men have cut every home tie and gone forth to places utterly desolate.

In this hour of crisis, the destiny of our nation lies largely in the hands of the man who dares and performs, the constructing contractor and engineer. It is fortunate that this is so.

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New York, N.Y.

Structural Solutions for Redundancy

To the Editor: The solution of a frame of multiple redundancy using the method of least work, as given by Mr. Laughlin in the July issue, and the subsequent discussion are most enlightening. In particular, I like Mr. Goodrich's discussion (October issue) and in fact, had prepared a discussion on very similar lines. A few comments on various methods for such solutions may be in order.

If authors continue to insist that Castigliano was the father of the principle of least work, Ménabréa should be called its grandfather, for he clearly enunciated the principle in 1858, while Castigliano's demonstration was not published until 1879. The principle of deflections by the area-moment method was published by Mohr in 1868 and by Greene in 1874.

The earliest recorded solution for the reactions of a statically indeterminate beam was by Dr. Thomas (Young's Modulus) Young in a letter to one Mr. Tilloch dated August 3, 1815. The solution was made by deriving the equation of the elastic curve. This was before Ménabréa, Mohr, or Greene. Since Mohr and Greene, no useful purpose has been served by the publication of books and articles on the application of the principle of least work to statically indeterminate beams, yet such works continue to be written.

Some authors who still cling to this alleged classic method claim that it is necessary as the best foundation for a knowledge of structural theory. The writer's experience denies this claim. The student's attention is drawn away from the structure by the maze of algebraic and differential expressions. Least work per se is an abstract idea. It cannot be seen, nor can it be shown on any structural diagram. But deflections can be pictured. They are linear dimensions upon which the student's attention can be kept focused. To tell a student that structures (like some individuals) are lazy and will do no more work than the irreducible minimum is a qualification that doesn't clarify the problem.

The principles of work and least work continued to be useful in solving stresses in framed structures having redundant members, until the shorter and simpler method of Williot equations was discovered and later published by the writer in *Engineering News-Record* for April 26, 1934, also in the 1935 Transactions of the Society (page 580). Dr. Young's solution previously referred to and a comparison of Mohr with Greene may be found in my article in the April 1917 *Journal of Western Society of Engineers.*

When one compares the amount of labor involved in the various solutions, the conclusion regarding the superiority of the method of least work is obvious. To the writer, "least work" invariably suggests "most work."

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Emergency Role of Timber

To the Editor: Lumber has done a good job pinch-hitting for steel in the present emergency. It has probably done as good a job in the structural field as in any of the numerous uses where it has been substituted. Nevertheless, it must do an even better job, for steel is tight and is getting tighter. When one material is substituted extensively for another, the substitute in turn frequently becomes critical. That is happening with wood. Construction lumber is under a limitation order. Certain grades and species have been practically frozen to channel them into defense uses, for the over-all lumber situation is not good. The estimated shortage for 1942 is about 6,000,000,000 fbm.

The use of glue and connectors can do much to aid in meeting the anticipated shortage. They make possible the use of short lengths and narrow widths, which are comparatively plentiful. Most engineers, however, are not familiar with the use of glue and connectors and have hesitated to use them to the extent necessary in the emergency. In his article in the October issue, Mr. Keith has pointed out how and where they can be used. I will add only that the development of the synthetic resin glues has made possible the use of glued-up members in exterior structures where the members are exposed to the most adverse moisture conditions.

Another possible aid to meeting the shortage is to increase the working stresses for wood. Working stresses, however, are controversial, for engineers range from conservative to radical. How much stresses can be raised depends on the viewpoint and the knowledge the engineer has of wood. Four items enter into the so-called factor of safety for wood. They compensate for the known effect of the defects permitted in a grade, the variability of clear wood, the effect of long-time loading, and probable over-load due to accident or ignorance. The last is the true factor of safety and is $1^{2}/_{3}$ as compared with the so-called factor of safety of between 5 and 7. Aside from adjusting the working stresses for actual loading conditions by modifying the factor used for long-time loading, as suggested in Mr. Keith's paper, there is little chance of materially increasing the working stresses for timber without decreasing the true factor of safety. The defect and variability factors are known, and cannot arbitrarily be changed.

What the true factor of safety should be depends on engineering judgment. The present factor used with wood is conservative. In emergencies there are justifications for taking greater risks than in normal times. Even in normal times some engineers consider the present working stresses for wood too low. There is, however, an opportunity for considerable conservation by consideration of the factor for long-time loading and the assumed live loads. Live loads contain a second factor of safety and, to some extent, duplicate the factor provided for over-loading. For example, floor loads are often the maximum loads that could conceivably be placed on the floor. Some of the assumed loads have such a high factor of safety that a more realistic estimate of the probable maximum load would conserve more lumber than any safe increase that can be made in working stresses. It is not necessary to design for a load lasting ten years when the load will not be on the structure for any such period.

R. P. A. JOHNSON
Wood Consultant, Conservation Division,
War Production Board
Washington, D.C.

Forum on Professional Relations

CONDUCTED COLUMN OF HYPOTHETICAL QUESTIONS, WITH ANSWERS BY DR. MEAD

Notice regarding this series of questions and replies appeared originally in the September issue. The column will be continued monthly under these same auspices. The following answer includes Dr. Mead's comments on Question No. 2, "A senior engineering student had signed up with a company of good standing about three months before graduation. After spending considerable time in obtaining further information concerning the work available and the general nature of the particular job he had accepted, he found that the thing he would like best to do was not offered by this company. Would he be justified in asking for a release? Must he take this first job if he is positive that he is making a mistake? What would be the best thing to do in a case like this?"

SELDOM a year passes that one or more engineering students, from almost every engineering school, anxious to secure employment immediately after graduation does not eagerly accept some offer several months before graduation. He may then receive, shortly before graduation, another more attractive offer often at a higher salary. Because of his straitened financial circumstances, this is bound to be a great temptation.

Many an engineering student finds it difficult to obtain the time and money needed to complete a technical course. In many cases it is necessary for him to secure part-time employment during the school period as well as to work during the summer vacation in order to meet the expenses involved; and frequently he graduates with a considerable debt resulting from money borrowed.

At such a time, therefore, higher wages of $25 or possibly $50 per month have an almost irresistible attraction. As the young graduate at this time is probably not financially responsible, and even if he were he probably would under the circumstances seldom be sued for breach of contract, the temptation is strong to notify the employer bluntly that he has decided to accept a better and a more lucrative job. Such an action on his part is not only unethical but is apt to affect seriously his reputation as a man of his word. It is also apt to prejudice the employer against other graduates of his college, and even against all graduate engineers.

The young man in such a case enters the engineering field by an unethical action which may have a serious effect on his professional ideals and injure his reputation at the very start of his career.

Few graduating students are sufficiently well informed concerning their chosen profession to choose with any great degree of certainty the particular work which should be their life work. In general this can be definitely determined only by available opportunities and experiences. This may not be so certain in the case of more mature students who have had the opportunity of part-time work in the particular line of their chosen profession. Interest in the work is surely one of the important factors in success, but an intelligent man can and should force his interest in any work he untertakes.

The writer believes that much more consideration should always be given to both the character of the work and the wages paid before the first job is accepted, and not afterwards; he believes that once the job is accepted the decision should be final. When the circumstances are such that the young graduate feels he must accept a later offer, he should be manly enough to take the matter up with the employer whose offer he has already accepted, to explain the conditions, and to ask for a release from his engagement. That the condition described in this question are not unusual is shown by the comments of C. E. Moffet, Jun. Am. Soc. C.E., of Los Angeles, who has recently had a similar experience:

"Very few senior engineering students know exactly what they want to do, since their engineering training is mostly basic science and they have very little experience in applying their knowledge to practical situations. Hence, when a student makes the assertion he is sure he knows definitely what he wants to do, there is always a question concerning his definiteness.

"The student himself was in error in accepting the job before he had fully satisfied himself as to the nature of the work done by the employer. I think any employer appreciates a prospective employee's investigation of the type of work he may be required to do. The practice of many employers of offering summer employment to undergraduate engineering students they may be interested in employing later facilitates mutual understanding.

"Having accepted employment which he is sure will not be satisfactory, the student should by all means take his problem to his employer, who usually does one of two things: (1) Shows the new employee where he is mistaken in his decision; or (2) helps him secure the type of employment he desires.

"Few employers of engineers want an employee who does not like his work, for engineering work in general is done by men who thoroughly enjoy their work. Also, most engineers are very interested in the training of young men in the profession.

"A conference such as is suggested here will undoubtedly settle all questions for the new employee in a professional manner satisfactory to all concerned."

D. W. MEAD, PAST-PRESIDENT AND H. M. AM. SOC. C.E.
Madison, Wis.

Similar problems of professional relations will be treated by Dr. Mead each month. Question No. 3, given in the October issue, will be answered in December. Next in order, for written comments open until December 5 and Dr. Mead's reply in the January CIVIL ENGINEERING, is:

QUESTION 4: *A sales engineer is sent out to determine the needs of a certain installation for a prospective customer. He finds that a definite type is required and knows that the only machine, similar to the desired type, manufactured by his firm is not correctly applicable and will probably make the installation unsatisfactory, and there is not time enough to design a special machine. However, he also knows a competitor whose machine would exactly fill all requirements. Should the engineer recommend the machine made by his company or the machine manufactured by the competitor? Does the client or his company comes first?*

SOCIETY AFFAIRS

Official and Semi-Official

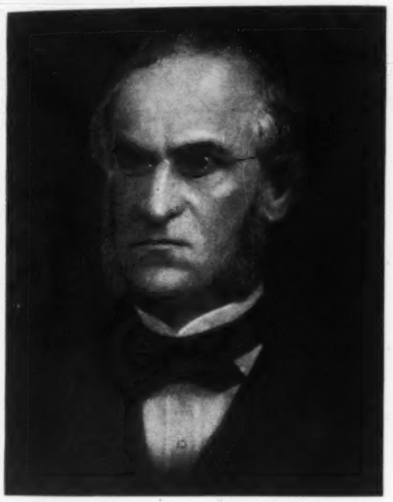
Launching the Society, 1852

As Viewed from the Ninetieth Anniversary, November 1942

No organization can afford to ignore its early development. An anniversary is especially an incentive to look back and to "point with pride." And when the organization has gained the ripe old age of ninety years, has persisted through hardships, wars, and depressions, the time seems to be especially propitious for such an evaluation and review.

From the vantage point of today, it is a bit difficult to understand and to appreciate fully the obstacles to civil engineering solidarity in 1852. The country was relatively small—its farthest expansion had not penetrated much beyond the Mississippi. True, Rogers and Clark, as well as military and surveying missions, had gone farther, but by and large the Mississippi was "The West."

Further, the great concentration of population, of industry, and of wealth was on the Atlantic—one might well say, the North Atlantic seaboard. And the country was still largely provincial, for communication was poor as well as difficult. Engineers saw some of the advantages of association but at the same time they could not gainsay its difficulties.



James Laurie, First President of the Society, for the Term 1852–1867

Few Precedents

History and experience were against it. Of course the Institution of Civil Engineers (Great Britain) had been in existence a matter of over thirty years; but England was the "tight little isle," compact, thickly populated, and well developed. Yet some far-seeing engineers in America had sensed the possibilities of an organization and had called a meeting in Baltimore in February 1839. Enthusiasm was high and the venture looked both attractive and successful.

Confidence was also high—indeed, too high. The organization was to take in all of the country. It was already nation wide in the minds of these enthusiasts. So an organizing committee of seventeen prominent engineers from far and near was appointed, with never a fear of failure. The formal meeting to complete the details was to be held two months later in Philadelphia.

But this meeting turned out to be small and feeble, and failed dismally. Apparently the idea was ahead of its time. Perhaps the leaders of engineering were individualists, not trained in professional cooperation. Perhaps there was more than a vestige of jealousy between personalities and between cities. Whatever the cause, it was quite evident that the time was not yet ripe for such a venture.

An Unimpressive Start

As compared with this abortive attempt, the beginning of the American Society of Civil Engineers thirteen years later was modest—one might almost say, too modest. Certainly the organization was not robust and it barely had the vitality to carry over a period of inactivity—a sort of coma extending beyond the Civil War. But the fact remains that it was willing to start small and to grow, and that it did have the virtue of persistency due in large part to the efforts of a small yet virile group of interested officers and members.

Those early days of the Society were not such as to command any great confidence. The steps were halting, if not feeble, and sometimes they even seemed backward. Such are often the struggles of a young organization.

Yet in its modest way, the Society started bravely enough—even, one might say, under brilliant auspices. Such sponsors as James Laurie, Alfred W. Craven, and James P. Kirkwood were almost a guarantee of eventual success. Twelve men attended the first or preliminary meeting on November 5, 1852, held in Alfred W. Craven's office in the Croton Aqueduct Department building, situated in what is now New York City's City Hall Park. Meetings were frequent, if not large. There were eight gatherings in the first year, 1853, but the average attendance was only six. Still, the group had quality if not quantity. In its first roster appeared 55 names—charter members—including such men as John A. Roebling, founder of a bridge-building dynasty, and Theodore Dehone Judah, soon to become a pioneer in transcontinental railroading. Then there were 16 others who served the Society then or later as officers, including 7 who became Presidents. Surely "there were giants in those days."

Expansion or Decay?

What really caused the first upheaval was an advanced proposal to promote the organization. The wiser heads in the early group clearly saw that some physical rallying point was needed, about which the small group could build. A committee therefore recommended, after study, that a permanent office or meeting center be leased to serve the whole organization, but more particularly the "country members" when they came to New York City. Against this proposal various arguments must have been urged, with some vehemence—the record discreetly omits all details. With counsel thus divided, the proposal was not even put to motion.

This was in March 1855. The shock was almost a death blow. Little did these men realize that a "faint heart" would thus stun the budding Society. The fact remains that the organization went into hibernation forthwith. It looked as though it had succumbed—and in the stirring days preceding the Civil War, civil engineers soon forgot it.

Windsor Castle on the Thames
Here Queen Victoria Entertained Society Members at the Time of the Historic Convention in London, July 1900

But not all of them, fortunately. Societies are as persistent and virile as the men that conduct them. How fortunate then that foresight and character were given these leaders. James Laurie, the first and continuing President, never forgot his responsibilities. For the long period of over twelve years the Society lay dormant. Then what seemed to him a propitious time for resuscitation came, in October 1867. He called another meeting in New York and again fanned into flame the smoldering interest of the members.

Old members responded, new ones were added. Profiting by the previous mistake, suitable headquarters were immediately found in the Chamber of Commerce Building near Wall Street. A library was started in a modest way. New leaders took up the torch. At a meeting in December, 54 new members were elected. In short, the Society became firmly established—not large, not influential, not noted, but a really going concern.

One feature of these early struggles stands out. The members and officers had keen financial sense and high business principles. They believed in spending less than the income. So there was always a surplus in the treasury. Even at the beginning of the interlude, in 1855, this was about $250. Doubtless few of the members gave much thought to this feature during the succeeding period of inactivity. Great was their surprise therefore to find in 1867 that a capable stewardship had indeed multiplied their talents. Part of the funds had been at interest in a savings bank and part invested in New York Central bonds.

With surprise and delight the renewed Society found itself possessed of assets totaling about $1,600. This was a real shot in the arm, a much needed stimulant. It was an augury of importance for the future. Never in the succeeding years has the Society lacked financial foresight. Its commanding place after ninety years is in large part due to the vision of James Laurie and those other early giants, who builded better than they knew. All honor to them, on this the ninetieth anniversary of the birth of the organization in behalf of which they so earnestly and so successfully labored.

Niagara Falls, Ontario, Host to Fall Meeting

Engineering Institute of Canada and American Society of Civil Engineers Hold Joint Sessions

IN SPITE OF the high priority rating placed on the time of American and Canadian engineers, it is significant that about 400 members of the Society and of the Engineering Institute of Canada, together with their guests, attended the joint engineering meetings held at Niagara Falls, October 13 to 15, 1942. Long famed as a resort center, this popular spot proved to be a most convenient meeting place for the outstanding engineers of these two great neighbor nations. The technical meetings, planned to deliver the latest and most critical developments in engineering science, created wide interest.

Preceding the regularly announced meetings there were sessions of committees of the Society and of the Board of Direction, as well as three sessions of the Board itself. The latter occupied a full day on Monday until almost midnight. This permitted the attendance of the Board at the Tuesday Local Section meeting. A more complete account of the Board's actions will appear in a later issue. Some of the accomplishments of the Board are noted in separate items in this issue.

Good fellowship abounded throughout, and social gatherings were provided for the "breathers" between the stimulating technical sessions. To provide hospitality for the members, guests, and ladies in attendance, the General Brock Hotel is admirably suited; it has adequate facilities and a well-trained staff to care for such occasions. At every opportunity the attention of the assemblage naturally gravitated to the panorama of the Falls, seen from the front of the hotel and from many of the rooms.

Someone with an eye for utility wisely drew the shades in the meeting rooms facing the Falls. Otherwise, the attention of engineers would be drawn to this magnificent sight of world-wide renown. During the intervals before and between meetings, the visitors spent much time on the promenade alongside the gorge. Their steps usually led toward the Falls and the mighty spectacle so full of meaning to the engineering eye. Especially was this true of those who were fortunate enough to arrive somewhat ahead of the regular meeting. Then the weather was typical of Indian summer with just enough tang in the air to remind one of the fall. Perhaps it was fortunate that with the beginning of the technical sessions, the weather became overcast, with some rain, so that the natural temptation to enjoy the grandeur of the Falls at the expense of the technical meetings was diminished.

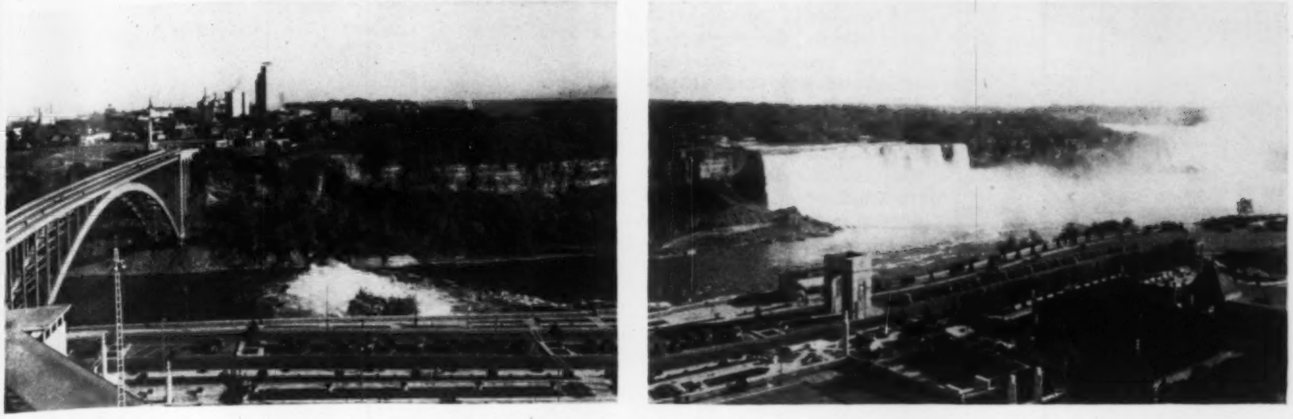
LOCAL SECTIONS CONFERENCE

Tuesday, October 13, was devoted to the Local Sections Conference. There the discussion of the activities of Local Sections in civilian protection shared interest with employer-employee relationships in the engineering profession.

An excellent opportunity for making new acquaintances and reviewing old ones was offered at the Tuesday luncheon in the hotel's ballroom. The meeting with the ladies at the evening's informal dinner came as a happy close to a day of serious discussion.

All those engineers and their friends who were present in the hotel were invited to this dinner. The gathering was notable for the gaiety and good fellowship everywhere in evidence. Informal singing was popular, especially that featuring war selections and Canadian folksongs. In the midst of the singing, following the

LOCAL SECTION DELEGATES, BOARD MEMBERS, AND GUESTS GATHER AT HOTEL ENTRANCE



Fine Panorama of Engineering Interest Greeted Visitors from the Hotel's Rainbow Room

Left: Rainbow Bridge, Over Gorge, Connects Niagara Falls, N.Y., with Niagara Falls, Ontario (Foreground). Right: Beautifully Landscaped Park and Promenade Give a Fine Prospect of American (Near) and Canadian Falls

dinner, a blackout descended without warning but it failed to interrupt the enjoyment.

Manpower the Subject for International Discussion

At the formal opening session on Wednesday morning, the exchange of courtesies between the two societies was followed by an opportunity to learn of the control of manpower, especially in Canada. The resulting discussion carried over to the many groups attending the luncheon in the ballroom.

In a closed session Wednesday afternoon, the engineering features of civilian protection were presented in a symposium. Although the system of signed tickets necessary to limit attendance took some time, it met with fine cooperation, which expressed the willingness and desire of the membership to protect essential information.

President Black of the Society, and Secretary Wright of the Institute, on the Platform at a Technical Session

While phases of civilian defense in Canada and the United States were uppermost, reference was also made to experiences in England and elsewhere among the Allied Nations. It was a large and interesting session, with discussion that continued until the last minute before the hall had to be cleared for dinner. And it was really confidential, with no report or record submitted. Nevertheless it is no betrayal of confidence to state that engineers received real help in this open discussion and exchange of viewsregarding civilian protection.

Formal Dinner and Address

Attendance at the luncheons and dinners always exceeded expectations. For economy of space it was necessary to serve at long tables extending the entire length of the ballroom. Perhaps this did not give as dignified an effect as might have been achieved with smaller tables and accommodations. Nevertheless it did develop the cordiality and the good fellowship that only large groups can inspire.

Following such a meeting Wednesday noon, in between the technical sessions, C. R. Young, M. Am. Soc. C.E., president of the Engineering Institute of Canada, delivered an outstanding address on "The Place of the Engineer." On all sides this was welcomed as one of the finest presentations of the whole meeting. Professor Young has promised to put his address in writing for the benefit of all readers of Civil Engineering.

Again in the evening the capacity of the ballroom was taxed to the limit, as another gathering of 250 sat down to a formal dinner. The American guests were glad to join with the Canadians in toasts to the King, followed by one to the President. There was no entertainment, but there was a fine inspirational address by Dr. H. J. Cody, president of the University of Toronto. He defined and illustrated what civilization is and how it has developed to the present day, ending with a strong and eloquent plea for international cooperation on the theme, "We are in it together in the defense of civilization."

It had been announced that a surprise was in store but this did not materialize. Unfortunately, a promised lighting of the Falls had to be canceled for military reasons. With some truth it was remarked that this was a double loss in the sense that on the previous night there was a blackout of expected illumination, and now on Wednesday a similar loss was the portion of the meeting Dancing followed in the same ballroom and was enjoyed until the small hours.

Technical Sessions Highlighted

Five of the Technical Divisions of the Society held sessions Thursday in meeting rooms provided at the convention hotel. It is hoped that a number of the excellent papers presented may appear in later issues of Civil Engineering.

At the close of the morning sessions, delegates met in the ballroom for luncheon. A very interesting description of Army Engineer training was presented by Brig. Gen. E. H. Marks, Commanding Officer, Fort Belvoir, Va. His talk was supplemented by a short moving picture illustrating the life and training of engineer troops.

Officers of the Society and the Institute

Front Row: T. H. Hogg, Past-President of the Institute; C. R. Young, President of the Institute; C. M. Spofford, Vice-President of the Society; E. B. Black, President of the Society; K. M. Cameron, President-Designate of the Institute. *Back Row:* L. Austin Wright, Secretary of the Institute; A. J. Grant, Past-President of the Institute; C. H. Stevens, Vice-President of the Society; C. J. Mackenzie, Past-President of the Institute; C. B. Burdick, Vice-President of the Society; F. H. Fowler, Past-President of the Society

ENGINEER PRESIDENTS AT THE NIAGARA FALLS MEETING
C. R. Young, of the Engineering Institute of Canada (left), and E. B. Black, of the American Society of Civil Engineers

A number of trips and teas were planned for the ladies. All were generously attended and greatly enjoyed. In addition to the dinner meetings, an afternoon bridge and tea on Wednesday were held in the Rainbow Room. From the windows of this room, at the top of the hotel, there is an excellent view of the Falls—a sight which never failed to attract the visitors' attention.

A closer view of the Falls was afforded on Thursday morning when the celebrated "Maid of the Mist" accommodated a party of ladies (and some of the men) to view the Falls from the gorge. This trip carries the visitor almost up into the Canadian Falls and gives a splendid idea of the magnitude and impressiveness of this internationally famous spectacle.

That afternoon the ladies had the pleasure of listening to a lecture on "Astronomy's Debt to the Engineer," by Dr. Alice V. Douglas, dean of Queens University.

CROSSING THE BORDER

As far as could be learned there were no difficulties to any of the guests in meeting the requirements of the border officials on either side. Transfer from one country to another across the Rainbow Bridge was simplicity itself. Both the Immigration and Customs officials were courteous and helpful. As a result the travel back and forth was expedited and quite a number of the American guests found opportunity to take meals or to do shopping in Niagara Falls, N. Y. Still others—and larger numbers—made trips to Hamilton, Ontario, and even to Toronto or Buffalo. Needless to say many souvenirs of Canada found their way back to the United States. Some of the illustrations in this issue will indicate a few of the features of the meeting, including the fine opportunities for the development of friendship and understanding between Canadian and American engineers.

SUCCESSIVE SOCIETY PRESIDENTS GATHER AT NIAGARA FALLS
Left, Future President, Ezra B. Whitman, Official Nominee for 1943; Center, Present Incumbent (1942) E. B. Black; Right, Most Recent Past-President (1941) Frederick H. Fowler

The exchange of last-minute developments in the technical field, and the development of a feeling of comradeship between the engineers of the two countries, made the meeting a priceless experience for those in attendance. Officials of the two countries coped admirably with the difficulties that now beset the successful arrangement of such a meeting outside the boundaries of the United States. The Niagara Falls Meeting will long be remembered by both Canadian and American engineers.

George Stewart Davison, 1856–1942

IN the death of George Stewart Davison, which occurred on October 3, the Society loses one of its most distinguished members. Mr. Davison, who was 86 at the time of his death, was the earliest living Past-President, having served from January 1926 to January 1927. He had held this distinction for only a brief period—that is, since the death of Past-President Talbot just six months previously. Many years earlier (1903 to 1905) Mr. Davison served a term as Society Director, and he was Vice-President in 1923 and 1924. He was elected to honorary membership in 1937. Perhaps best known as president of the Gulf Refining Company, Mr. Davison most recently devoted his time to the Davison Coke and Iron Company, the Pennsylvania Water Company, the Allen S. Davison Company, and the Green Bag Cement Company. He was also director of the Pennsylvania Airlines and Transport Company.

GEORGE STEWART DAVISON, PRESIDENT OF THE SOCIETY, 1926

Upon his graduation from Rensselaer Polytechnic Institute, which he was to serve later as trustee, Mr. Davison began his career as an engineer for the Pennsylvania Railroad. There followed several years with the U.S. Corps of Engineers and the Atchison, Topeka and Santa Fe Railway. His later work with the Pittsburgh, Chartiers and Youghiogheny Railroad culminated in his promotion to general superintendent. For ten years he was a member of the engineering firm of Wilkins and Davison, and then in 1900 he became general manager of the Monongahela, Pittsburgh and Birmingham Railway. His first work for the oil industry came in 1905 when he accepted the position of assistant to the president of the subsidiary companies of the Gulf Oil Company. After six years in this capacity he became president of Gulf Refining and subsidiary Gulf companies. These posts he held until his retirement in 1929.

Mr. Davison's efforts in behalf of the profession led to recognition in the form of honorary degrees from the University of Pittsburgh and his alma mater, Rensselaer Polytechnic Institute. He was a member and former president of the Engineers' Society of Western Pennsylvania.

A Close Shave—and a Saving to Members

BY POSTAL regulations now in force, PROCEEDINGS is mailed to members as second-class matter to take advantage of the economical pound rate. In two months of each year this saving (over parcel post mailing, for example) is considerably enhanced by the fact that PROCEEDINGS has two parts, Part 2 being the Yearbook number (April) and the paper-bound TRANSACTIONS (October).

In October, however, the regular edition, with Parts 1 and 2, is considerably reduced since about half of the members have their TRANSACTIONS bound in cloth and leather. These latter are delivered some weeks later. The October PROCEEDINGS for such members must be delivered by parcel post.

A curious situation arose in preparing the recent October PROCEEDINGS for mailing, when its weight was discovered to teeter-totter on the scales just enough to throw it out of the 8-oz class. In cooperation with the postal authorities and the Lancaster (Pa.) Press, it was decided to trim the edges of the parcel post copies sufficiently to reduce the weight to the regulation 8 oz.

The result is an admittedly poor match with a shelf full of standard-size PROCEEDINGS. But it was reasoned that this class of member (receiving cloth- and leather-bound TRANSACTIONS) would use PROCEEDINGS for clipping purposes rather than filing. All the material in the October PROCEEDINGS, it is expected, will be collated, indexed, and published in TRANSACTIONS in due course. A reasonably generous supply of unclipped PROCEEDINGS has been placed in stock for those who may wish to exchange their "shaved" copy for one of standard size.

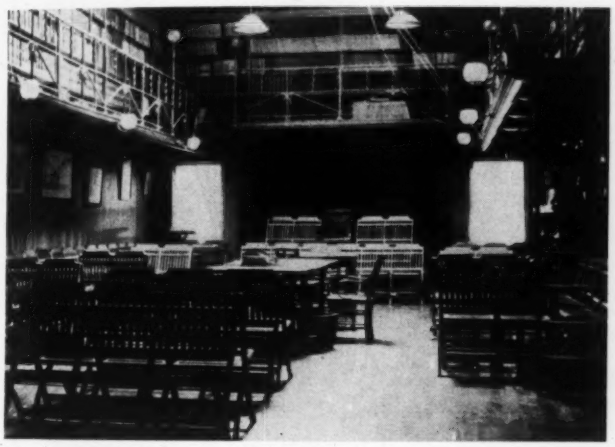
It was a close shave—and a saving to members of $434.00.

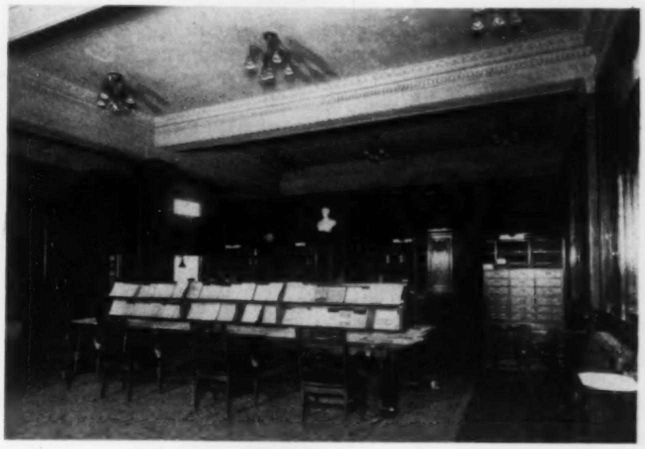
High Lights of Society History

Chronological List of Some of the Important Events from 1852 to the Present

In general, the matters mentioned are those which concern the Society alone. Many important matters of joint participation with other organizations are not included.

Founding of the Society, 1852
Activities lapsed, 1855
Revived by President James Laurie, 1867
First Society rooms opened, Chamber of Commerce Building, 63 William Street, New York City, 1867
Grade of "Associate" established, 1872
Norman Medal established, 1872
First Society meeting outside New York City, Chicago Convention, June 1872
Volume I of TRANSACTIONS printed, 1873
PROCEEDINGS and TRANSACTIONS separated, 1873
Advertising accepted (briefly), 1873
Grade of Junior established, 1874
Exhibit at Philadelphia Exposition conducted by Centennial Commission, 1876
Society received one of nine Grand Prizes to Americans for exhibit at Paris Exposition, 1878
First Society-owned Headquarters opened, East 23d Street, 1881
Membership reaches, 1,000, 1887
Membership qualifications raised, grade of "Associate Member" established, 1891
Report on Standard A.S.C.E. Rail Sections, 1893
New Society Pin (Badge), 1894
Membership organized in 7 geographical voting districts, 1895
PROCEEDINGS issued monthly, 1896
Fifty-seventh Street Society House dedicated, 1897
Society Headquarters moved to 57th Street, 1897
Convention in London, England, and reception by Queen Victoria at Windsor Castle, 1900
Classified Catalogue of 32,000 subjects in Society Library, 1900
International Engineering Congress at Louisiana Purchase Exposition conducted by Society, 1904
Members of Institution of Civil Engineers (Great Britain) entertained, 1904
Six extra volumes of TRANSACTIONS (International Engineering Congress, St. Louis) issued free to members, 1905
First "Local Section" (San Francisco), 1905
Convention in Mexico City, 1907
Four volumes of TRANSACTIONS instituted per year, 1909
Special Society excursion in chartered ships to Panama Canal, 1911
TRANSACTIONS in single volume on India paper, 1912
Code of Ethics adopted, 1914
Revision of geographical division into 13 Districts, 1915
Joined Founder Societies, 1916, and established in Engineering Societies Building, West 39th Street, 1917
Society House on 57th Street loaned to U.S. Food Administration, 1917
Final report on Valuation of Public Utilities, 1917

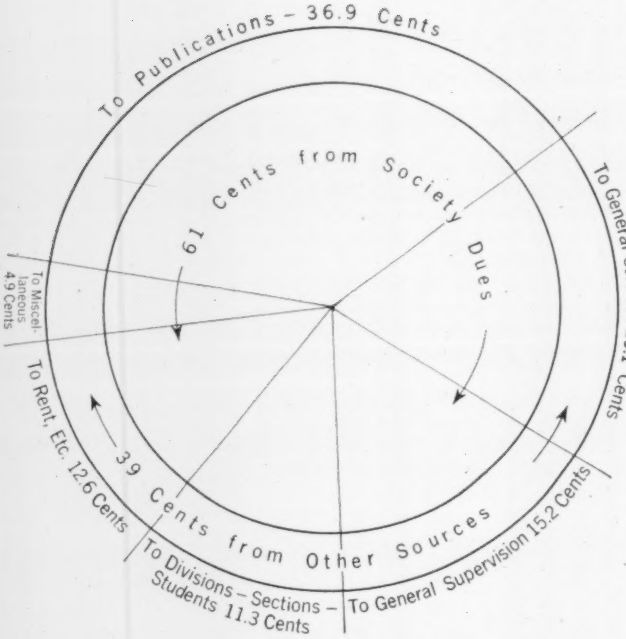

In the First Society House, East 23d Street, 1881–1897


In the 57th Street Society House, 1897–1917

In the Engineering Societies Building, 15th Floor, 33 West 39th St., 1917–1923

Present Form, as Rearranged in 1923, with Photographs of Society Presidents

EVOLUTION OF THE SOCIETY'S READING ROOM AT HEADQUARTERS, NEW YORK CITY



THE SOCIETY DOLLAR—WHENCE AND WHERE
From Annual Report for 1941

Engineering Societies Employment Bureau established, 1918
TRANSACTIONS omitted for reasons of war economy, 1919
Report of Development Committee, 1919
First Student Chapter (Stanford), 1920
Secretary Hunt retired after 28 years of service, 1920
Membership total of 10,000 reached, 1921
Society semi-monthly meetings discontinued, 1921
First Technical Division (Sanitary Engineering) formed, 1922
Quarterly meetings begun, 1922
Final reports on Specifications for Steel Railway and Highway Bridges, 1923–1924
Report on Standard Specifications for Concrete and Reinforced Concrete, 1924
Death of Secretary Dunlap, 1924
Committee on Aims and Activities reports, 1925
Uniform Registration Law approved, 1925
Fifty-seventh Street property leased on long-term basis, 1926
Establishment of Part II of PROCEEDINGS (4-page news sheet), 1926
Freeman Fund established, 1924, and first appointments, 1927
Manual of Engineering Practice No. 1 issued, 1927
Society joined Engineering Council, 1929
Functional Expansion Program adopted, 1929
Allocation of members into present 16 Districts, 1930
CIVIL ENGINEERING established, 1930
Final Report on Steel Columns, 1933
TRANSACTIONS issued as Part II of PROCEEDINGS, 1934
Final payment on mortgage on 57th Street property, 1934
Final Report on Concrete and Reinforced Concrete Arches, 1935
Field Secretary appointed, 1935
Defense of members falsely accused, 1935
All members assigned to Local Sections, 1938
Grading Plan and Compensation Schedule for Engineers issued, 1939
Factual Survey of Compensation for Engineers, 1939
Final Report on Wind Bracing in Steel Buildings, 1940
First Salary Survey of Engineers—Arizona Highway Department, 1940
Formation of Construction Advisory Committee, Army and Navy Munitions Board, 1940
Establishment of Committee on Civilian Protection in Wartime, 1940
Canvass for National Roster of Engineers, 1940
Washington, D.C., office established, 1941
Staff member appointed on employment conditions, 1941
Questionnaire on Members' War Efforts conducted, 1942

Additions to Honorary Membership

FIVE new names have been added to the roll of Honorary Members by action of the Board of Direction at its Niagara Falls Meeting and by subsequent acceptance of the members concerned. Those so honored are:

ALONZO JOHN HAMMOND, *Past-President, Am. Soc. C.E.*
LAWRENCE MILTON LAWSON, *M. Am. Soc. C.E.*
BEN MOREELL, *M. Am. Soc. C.E.*
BREHON BURKE SOMERVELL, *M. Am. Soc. C.E.*
SHERMAN MELVILLE WOODWARD, *M. Am. Soc. C.E.*

This list represents an impressive total of professional achievement. The professional experience of Mr. Hammond has been both interesting and varied. His years of consulting practice in electric railways, hydroelectric plants, bridges, and municipal work have been interspersed with several important public service connections in Chicago. His service to the Society has included membership on the Committee on Public Works (1932), and terms as Director (1926–1928), Vice-President (1929–1930), and President (1933).

The southwestern states have been the scene of Mr. Lawson's extensive work in irrigation and flood control. After many years with the U.S. Reclamation Service, he was transferred to the Department of State as Commissioner for the United States on the International Boundary Commission. In this capacity he has instigated and directed construction of large water-control projects along the Mexican boundary. An active author, Mr. Lawson has served on a number of technical committees of the Society, both local and national.

As Chief of Civil Engineers of the U.S. Navy, Admiral Moreell has shown remarkable ability to organize and accomplish public works construction far beyond any previous scale. His career in the Navy began in 1917 when he was commissioned a Lieutenant in the Civil Engineer Corps. His study of reinforced concrete design has resulted in his wide recognition as an authority in the use of this material in structures. A number of papers and standards have been prepared by him and are used widely by the profession.

Distinguished service during a long military career resulted in the appointment of General Somervell to the all-important post of Chief of the Services of Supply Division of the Army. He has been in charge of many interesting engineering investigations throughout the United States, Europe, and Turkey.

As a consultant and as a teacher, Mr. Woodward has won the esteem of his profession. His activities in the teaching field included service at the universities of Arizona and Iowa. Hydraulic and hydrologic studies incident to power, navigation, and flood control have been the main object of his consulting work, the most recent being for the Tennessee Valley Authority.

More complete records of the lives of these outstanding engineers and Society members will appear in the January 1943 issue of CIVIL ENGINEERING.

Hospitality Extended to Members in England

RECENT questionnaires sent out by the Society reached members in many spots normally remote from Society affairs. Illustrative of this is the return received from M. E. Habershon, Assoc. M. Am. Soc. C.E., of Walsall, England, which was accompanied by a letter expressing the following invitation:

"I shall be pleased to offer, from time to time, hospitality to members of the Society who may be serving in the American Forces in the Midland area of England. If any wish to avail themselves of this offer I would suggest that if practicable they might communicate with me direct at my house, 'Waverton,' 43 Broadway, Walsall, Staffordshire. Walsall is about 9 miles to the northwest of Birmingham."

Also a communication was received from C. W. Scott Giles, Secretary of the Institution of Municipal and County Engineers, 84 Eccleston Square, London. He sent this offer:

"I am directed to make known to your members that if any of them should be in Great Britain and would like to make contact with municipal engineers in this country, this Institution would be very glad to put them in touch with members in or near the place where they are stationed."

"American Society of Civil Engineers, Founded 1852"

Statement Adopted Following First Meeting Ninety Years Ago, November 5, 1852

Rooms of the American Society of Civil Engineers and Architects, New York

November 10th, 1852

"It has been for some time under advisement to form in the city of New York a Society of Civil Engineers, embracing also the kindred professions, with a view to their mutual improvement and the public good. Accordingly a meeting was called on the evening of the 5th of November of such professional men as were accessible and were supposed to be favorably inclined to such an association. The objects of the contemplated Society were laid before this meeting, as also the means by which it was proposed to accomplish the end in view. A Constitution was drawn up, discussed in detail, and finally, after much labor, approved and accepted as the basis for the government of the 'American Society of Civil Engineers and Architects.' Officers were elected in accordance with the provisions of the Constitution, and the Society was duly organized.

The Name

Our organization has never had any legal name but "American Society of Civil Engineers." At first, beginning in 1852, the words "and Architects" were included. During the early—mostly dormant—years this fuller name continued, but shortly after the reorganization or revival, at a meeting in March 1868, the present name was adopted by a vote of 17 to 4. Even this action was not established in law until in 1877 arrangements were made to incorporate as the "American Society of Civil Engineers."

"It becomes our duty, in conformity to a resolution of said Society, to address such members of the respective professions as are known to us throughout the country, and, laying before them in brief the result of their deliberation, invite them to cooperate in a furtherance of the aim and objects of the Society, so far as they may be found to accord with their individual views. Such gentlemen only as receive this circular are eligible as members of the Society by a bare notice of their desire to become such and a compliance with the accompanying forms (on or before December 1st, 1852). All others will be elected by ballot in conformity with the requirements of the Constitution.

"It will be admitted that no point in our country offers the facilities for rendering such a society of practical benefit to the public as well as to its own members as the city of New York, and so long as this city retains its present commercial importance, so long it will be a center around and within which there will accumulate by a natural law practical commercial and professional information not elsewhere to be sought, and which, embodying the elements of successful enterprise, may be regarded as a fund of valuable data, equally valuable to the man of science and to the political economist. Much of this information is, from its nature, unwritten, but is entirely accessible, and, under the auspices of a society formed for that purpose, could be rendered available to such members as may desire the benefit of it.

"The Constitution of the Society declares that it has for its object:

"The professional improvement of its members, the encouragement of social intercourse among men of practical science, the advancement of engineering in its several branches, and of architecture, and the establishment of a central point of reference and union for its members.

"Among the means to be employed for attaining these ends shall be periodical meetings for the reading of professional papers, and the discussion of scientific subjects, the foundation of a library, the collection of maps, drawings and models, and the publication of such parts of the proceedings as may be deemed expedient.

"Civil, geological, mining and mechanical engineers, architects and other persons who, by profession, are interested in the advancement of science, shall be eligible as members.

* * * *

"It will be seen that we contemplate the formation of a library, and the collection of plans, models, etc., not only of works completed, but of works while under construction, many of which of great practical value would never see the light but for some such combined effort on the part of the profession. And to enable such members of the Society as reside at a distance to aid in the general cause, communications from them on professional subjects are solicited, to be read at the stated meetings of the Society and placed on its files, and also to extend the benefit of the Society to the same class of members, all information of a professional character in the possession of the Society, will, at all times, be open to its members for examination and use. Thus, the benefits of our library and collection of plans, drawings, etc., will be brought within reach of such as are debarred, by reason of professional engagements, or distance, from joining in our periodical meetings or making research into our archives.

"It is scarcely necessary in this place, even did space permit, to enlarge on the many advantages which may be anticipated to flow from the judicious management of such a society as the one we have organized.

"In the formation of a constitution for our Society it has been the endeavor, so far as possible, to profit by the experience of similar societies which have preceded us in the same field, and we may be permitted to hope, that in framing that paper, we have succeeded in embodying those features from among them best calculated to ensure the result at which we aim.

* * * *

"Those to whom this circular is addressed, and who may wish to examine the Constitution and By-Laws of the Society, will be furnished with a copy of the same, by addressing Robert B. Gorsuch, Secretary Am. Soc. C.E. and A., Rotunda Park, New York, to whom all communications are requested to be made."

A Society Excursion?

Archives at Headquarters Have Yielded This Photograph, but No Hint as to Its Subject. The Flag and Barrel at the Stern, the Generous Hampers, and, Above All, the Headgear, Suggest an Engineers' Outing in England During the Gay Nineties. Can Any Society Historian or Sherlock Holmes Improve on This Guess?

Record of the Growth of the Society

A CHECK of membership records reveals that there are now more than 22,000 engineers and engineers-to-be who are affiliated with the American Society of Civil Engineers. Students, as members of 121 Student Chapters, number about 4,500, and as can be shown by reference to Fig. 1, have strongly influenced the trend in balance of membership grades.

Directly following the organization of the first Student Chapters in 1920, the number of men entering the Society as Juniors increased noticeably, as the triaxial chart shows. This trend would suggest further growth of the relative number of Juniors in the future. It is interesting to note that while the balance between Members and Associate Members has remained fairly constant since 1922, the increase in Juniors has been drawing the resultant of all grades steadily towards the midpoint of the chart, a balance of the three groups.

On this chart higher grades include Honorary Members and Members; the intermediate grade represents Associate Members and Affiliates; and the lower grade is that of Juniors.

Growth of total Society membership and its component parts are shown in Fig. 2. Members of Student Chapters are not strictly members of the Society, but these data are appended as a matter of significance to the remainder of the chart. These growth curves show the steady expansion from the turn of the century until the critical years following 1932 and the renewed vigor of the climb following 1936. Here again the effect of Student membership upon the increase in Juniors is apparent.

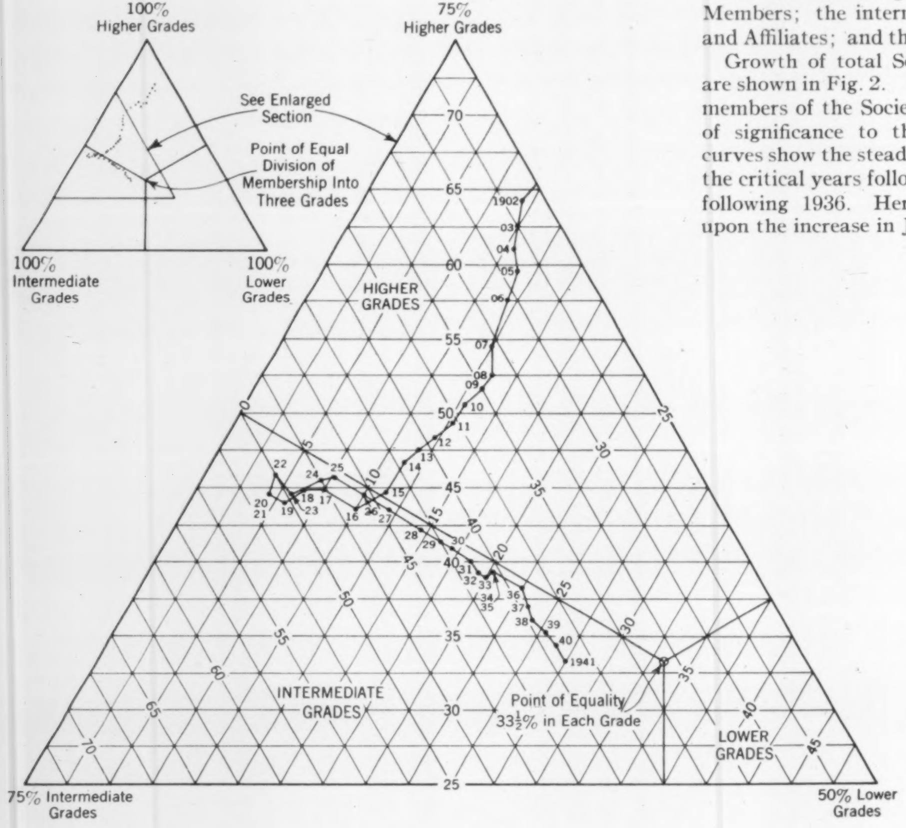


FIG. 1. TRIAXIAL CHART SHOWS PROPORTIONAL REPRESENTATION OF THREE SOCIETY MEMBERSHIP GRADES

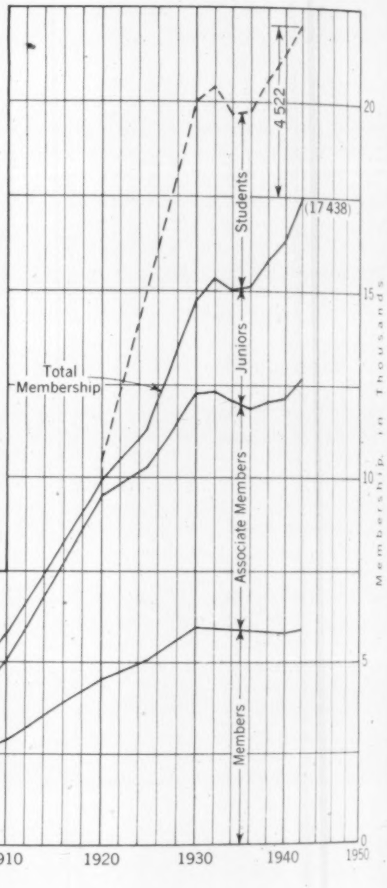


FIG. 2. GROWTH OF MEMBERSHIP IN THE AMERICAN SOCIETY OF CIVIL ENGINEERS

Some Rules for Developing the Society, 1868

IN THE SOCIETY'S early days, many members were giving thought to its problems and their solutions. One thoughtful letter, received in 1868, is especially interesting. It came from Charles Paine, of Toledo, Ohio, who was then one of the "country members" belonging to the Society.

"The success of the Society lies so near my heart that I venture to make some suggestion as to what would make it of interest to country members. I believe the Society aims at becoming for America what that of England is for that country, and to make its endorsement of an engineer of value, and most indispensable to professional respectability. Now the United States extends over so large an area that this will not be possible unless the Society gives the very strongest evidences of its strength and usefulness, or unless it counts as members all the really able and distinguished engineers of the country.

"First then, the able men who have started it have got to put forth all their energies for its advancement by using their personal influence to induce other able men to join, and by contributing their best papers to its meetings, which should be published promptly and sent to members. If this were done, as I understand it has before been proposed, I think it would be the best advertisement of the Society which could be made, because such papers would be of the first value to all engineers who wish to keep up with the latest experience.

"If to be a member does not make a man owe some duties to the Society and the Society some to him, the institution will not be able to sustain itself. On that account I think the rule of the British Institution would be of excellent value here, which requires that a member shall contribute some original paper, model, or drawing to the Society within a year after his election. It would bear particularly hard upon the humble individual who now addresses you, but for the good of the Society I would vote for the rule, and scratch my head until I got hold of some idea that would pass."

Years later Mr. Paine had an opportunity to put many of his ideas to the test—he became President of the Society in 1883.

Prize Awards for 1942

The recommendation of the Committee on Prizes was confirmed by action of the Board of Direction, at its meeting on October 12, in the selection of the following prize winners. The papers will be found in Transactions, vol. 106 (1941):

Karl Terzaghi, M. Am. Soc. C.E., the Norman Medal for his paper, "General Wedge Theory of Earth Pressure."

Charles F. Ruff, M. Am. Soc. C.E., the J. James R. Croes Medal for his paper, "Maximum Probable Floods on Pennsylvania Streams."

Shortridge Hardesty, M. Am. Soc. C.E., and Alfred Hedefine, Assoc. M. Am. Soc. C.E., the Thomas Fitch Rowland Prize for their paper, "Superstructure of the Theme Building of New York World's Fair."

W. Waters Pagon, M. Am. Soc. C.E., the James Laurie Prize for his paper, "Transatlantic Seaplane Base, Baltimore, Maryland."

William J. Wilgus, Hon. M. Am. Soc. C.E., the Arthur M. Wellington Prize for his paper, "The Grand Central Terminal in Perspective."

John F. Curtin, Jun. Am. Soc. C.E., the Collingwood Prize for Juniors for his paper, "Bridge and Tunnel Approaches."

In addition, four other prizes ordinarily are awarded. Of these the Construction Engineering Prize and Rudolph Hering Medal are given on recommendation of the Construction and Sanitary Engineering Divisious, respectively. The two Mead Prizes are ordinarily the subject of recommendations by the Committee on Professional Conduct. No award is to be made this year, however. Announcement regarding the other two is expected to be made later.

The prizes will be bestowed upon these winners at Annual Meeting to be held in January 1943. The accomplishments of the authors will be recounted more completely in a later issue of Civil Engineering.

Society History—Illustrated

Supplementing *the notes on Society activities through the years as given in this issue, there must be many other records, both narrative and illustrative, in the hands of members. For safekeeping and permanent record, these might well be loaned to, or deposited with, the Society at Headquarters. Notes, and particularly photographs, of meetings, excursions, and personages would be most welcome. For instance, who can supply illustrations of the famous Society visits to London and to Mexico City? These are but examples—all material on earlier or later Society history will be welcome.*

E. B. Whitman Nominated for President for 1943

The Society's Nominating Committee, meeting in Niagara Falls on October 11, with enthusiasm chose Ezra Bailey Whitman, of Baltimore, Md., as the Official Nominee for President for 1943. Mr. Whitman has accepted the nomination.

His prominence as a consulting sanitary engineer and his recognition as a public servant have attested his great interest in his profession. As a member of the firm of Whitman, Requardt and Smith, he engaged in the design and construction of sewage disposal plants and water supply systems, and in evaluation surveys. In public service he has been on many engineering commissions, the latest being the State Road Commission of Maryland, of which he is chairman.

Active in the affairs of his Local Section as well as in those of the national Society, Mr. Whitman served as Director during the years 1923 to 1925.

His personable and friendly character and his devotion to the profession were important considerations in his nomination for President of the Society. A more complete review of his professional attainments and personal qualifications will appear in a later issue.

Horner and Jens Closing Comments

In the October issue of Civil Engineering a list was published of closing discussions of Proceedings papers published for the first time in the forthcoming volume of Transactions. An important omission was that of "Surface Runoff Determination from Rainfall, Without Using Coefficients," by W. W. Horner, M. Am. Soc. C.E., and S. W. Jens, Assoc. M. Am. Soc. C.E. This paper was published in the April 1941 Proceedings and was quite actively discussed for more than a year. Those who keep up to date in their reading on hydrology will not wish to miss this important closing discussion.

International Engineering Comity—1889

A half century ago the Society cooperated in a manifestation of international goodwill that might well be recalled at the time of its ninetieth anniversary. It so happened that 1889 was a period of relative tranquillity, a sort of lull in the periodic wars that had plagued Europe. It was also a time of celebration—the Centennial of the establishment of the French Republic following the Revolution of 1789.

To commemorate that event, the French people planned an International Exposition in Paris. The United States and other countries were much interested. It seemed an opportune time for American engineers to visit Europe. Accordingly arrangements were made for members of the Society and the sister bodies of Mechanical and Mining Engineers to join in a trip to France, Germany, and England. Various references and reports, unfortunately not complete, may be found in Society publications. The total number of engineers in the group is not stated but it must have been large, because it included 52 members of the Society, accompanied by 33 of their ladies.

Accepting a special invitation from the Institution of Civil Engineers, the party spent a number of days in England in June of 1889. According to the record of William P. Shinn, in his Presidential Address the following year, "The most notable courtesy shown to the party was probably a dinner given by the Institution of Civil Engineers in the Guildhall of the City of London, by the express sanction of the city authorities. This marked courtesy was particularly striking, inasmuch as a similar courtesy had been extended but once before to any non-municipal visiting party to London." Another exceptional opportunity was obtained through "the special permission given by Her Most Gracious Majesty, the Queen, to visit and inspect her Royal Palaces and Domainsat Windsor and in the Metropolis."

To commemorate these ceremonies, and as an added evidence of goodwill, the Institution of Civil Engineers prepared a beautiful memorial. This "Illuminated Address of Welcome" was presented to the Society at its meeting the following November 6. It is still preserved at Headquarters. A reproduction in black and white appears on the Page of Special Interest in this issue. No such copy can, however, amply portray the delicacy and beauty of the original. The combination of red, blue, and gold coloring is striking. Six medallions, all exquisitely wrought by hand, indicate three groups of men and their accomplishments: on the left (top) James Watt, and below him on the bottom, his steam engine; in the center, Thomas Telford and his famous Menai Straits Suspension Bridge; and on the right, George Stephenson and his locomotive. No description can do justice to the workmanship and beauty of this hand-lettered and decorated scroll. The happy auspices of this trip in 1889 contrast with the fate of a visit of members of the Institution to America, scheduled for September 1939, and rudely prevented at the very last moment by the declaration of war.

Society Officers Nominated for 1942

The Second Ballot to determine the official nominees to Society offices, other than President, for 1943, was canvassed at Society Headquarters on October 15, 1942. The official nominee for President was chosen by the Nominating Committee on October 13, in accordance with Article VII, Section 4 , of the Constitution. The complete list of nominees follows:

For President:
- Ezra B. Whitman, of Baltimore, Md.

For Vice-Presidents:
- Zone II, Edgar Morton Hastings, of Richmond, Va.
- Zone III, Thomas Radford Agg, of Ames, Iowa

For Directors:
- District 1, Reuben Edwin Bakenhus and Dean Gray Edwards, both of New York, N.Y.
- District 2, Charles Blaney Breed, of Cambridge, Mass.
- District 6, Charles Francis Goodrich, of Pittsburgh, Pa.
- District 10, Nathan Washington Dougherty, of Knoxville, Tenn.
- District 13, Fred C. Scobey, of Berkeley, Calif.

These nominees will be voted on by the use of the final ballots sent to every corporate member at least forty days before the Annual Meeting in New York in January. One week before the meeting the ballots will be canvassed, and the elected officers will be inducted into office at the meeting. The official report of the tellers follows:

Report of Tellers on Second Ballot for Official Nominees

October 15, 1942

To the Secretary
American Society of Civil Engineers

The tellers appointed to canvass the Second Ballot for Official Nominees report as follows:

For Vice-President, Zone II

Edgar Morton Hastings	983
Void	0
Total	983

For Vice-President, Zone III

Thomas Radford Agg	539
George Eric Barnes	266
Wesley Winans Horner	508
Clyde Tucker Morris	163
Void	3
Total	1,479

For Director, District 1
(Two to be elected)

Reuben Edwin Bakenhus	530
Dean Gray Edwards	529
Void	0
Total	1,059

For Director, District 2

Charles Blaney Breed	242
Albert Haertlein	146
Void	1
Total	389

For Director, District 6

Charles Francis Goodrich	157
Void	0
Total	157

For Director, District 10

Nathan Washington Dougherty	348
Void	0
Total	348

For Director, District 13

Fred C. Scobey	313
Void	3
Total	316

Ballots canvassed		3,697
Ballots withheld from canvass		
From members in arrears of dues	73	
Without signatures	57	
With illegible signature	11	
Total withheld		141
Total number of ballots received		3,838

Respectfully submitted
Howard Holbrook, *Chairman*

Edward N. Whitney
Frank L. Greenfield
Robert E. White
Frederick W. Ockert
Eugene H. Paddock
Harry W. Stuber
Milton Brumer
Arthur S. Pearson
Joseph Farhi
Bernard Gaber
Bertram J. Ahearn
Tellers

The Society's Ninety Years

Items in This Issue:

Launching the Society, 1852 . . . . p. 629
Record of Growth . . . . p. 636
High Lights of Its History . . . . p. 633
Statement Adopted Following First Meeting . . p. 635
International Comity, 1889 . . . . p. 637
Some Rules for Development . . . . p. 636

Other References:

Historical Sketch of the American Society of Civil Engineers, 1852–1897, by Charles Warren Hunt (Volume printed by order of Board of Direction)

First Fifty Years of the American Society of Civil Engineers, 1852–1902, by Charles Warren Hunt. Transactions, Vol. 48 (1902), p. 220

Activities of the American Society of Civil Engineers During the Past Twenty-Five Years, by Charles Warren Hunt. Transactions, Vol. 82 (1918), p. 1577

Presidential Address at the Annual Meeting, January 15, 1919, by President Arthur N. Talbot. Transactions, Vol. 83 (1919–1920), p. 404

Research Activities of the American Society of Civil Engineers, by Arthur N. Talbot. Transactions, Vol. 86 (1923), p. 1280

Presidential Address, at the Annual Convention in Chicago, Ill., July 11, 1923, by President Charles F. Loweth. Transactions, Vol. 86 (1923), p. 1599

Eighty Years of Growth and Progress, by Secretary George T. Seabury. Civil Engineering, Vol. 2, November 1932, p. 665

When Queen Victoria Entertained, by Alfred E. Kornfeld. Civil Engineering, Vol. 5 (July 1935), p. 439

Relation of the National Society to the Engineering Profession, address at the Annual Convention, Salt Lake, Utah, July 20, 1938, by President Henry Earle Riggs. Transactions, Vol. 103 (1938), p. 1647

Relation of the Society to National Defense, address at Annual Convention, Denver, Colo., July 24, 1940, by President John P. Hogan. Transactions, Vol. 105 (1940), p. 1781

Total War and the Engineer, address at the Annual Convention, San Diego, Calif., July 23, 1941, by President Frederick H. Fowler. Transactions, Vol. 106 (1941), p. 1521

The American Society of Civil Engineers Today, address at the Annual Convention, Minneapolis, Minn., July 22, 1942, by President E. B. Black. Transactions, Vol. 107 (1942), p. 1688

Listings for 1943 Yearbook

For several years it has been the Society's custom to distribute to the membership early in October a post card requesting certain data for inclusion in the new edition of the Yearbook. This year, however, the regular Yearbook cards will not be sent out, in view of the exceedingly large number of replies received from the August 1 questionnaire instituted to determine the part our members are playing in the war effort.

These replies, of which there have been more than 13,000, are providing sufficient information to make the mailing of Yearbook cards unnecessary this year. However, those members who still have not informed Society Headquarters of any changes in address, professional title, or name and location of business are urged to do so as soon as possible. Address changes reported to the Society as late as January 16, 1943, will be included in the next edition of the Yearbook. Members reporting for military service are especially requested to notify the Secretary, so that they will be properly listed.

New Members of Division Executive Committees

One new member of the executive committee of each Division is elected yearly by the Board of Direction at its fall meeting. The new member takes the place of a similar member who is retiring in January. Suggestion for the new member is made to the Board by the nominating committee of the Division.

Following this plan, the Board at its Niagara Falls meeting chose the new member of the executive committee for each Division except the Highway Division. Special elections for terms shorter than normal were necessary in the case of the Engineering Economics Division, to take the place of W. W. Zass who has resigned; and in the Hydraulics Division, to take the place of Fred C. Scobey, who is expected to become a member of the Board of Direction. The length of these shorter terms is indicated on the following list, it being understood that all other appointees are for the full term of five years.

Division	Appointee
City Planning	John G. Marr
Construction	O. N. Floyd
Engineering Economics	David L. Erickson A. P. Learned (3 years)
Hydraulics	Wm. G. Hoyt Calvin V. Davis (1 year)
Irrigation	Geo. L. Henderson
Power	Walter Dreyer
Sanitary Engineering	Gordon M. Fair
Soil Mechanics and Foundations	A. E. Cummings
Structural	E. L. Durkee
Surveying and Mapping	Robert H. Randall
Waterways	W. W. DeBerard

New appointees take office in January, 1943.

News of Local Sections

Scheduled Meetings

Arizona Section—Annual meeting at the Westward Ho Hotel, Phoenix, on November 28, at 9 a.m.

Central Ohio Section—Luncheon meeting at the Fort Hayes Hotel on November 19, at 12 m.

Cleveland Section—Luncheon meeting at the Guildhall Restaurant on November 2, at 12:15 p.m.

Colorado Section—Dinner meeting at the University Club on November 9, at 6:30 p.m.

Dayton Section—Luncheon meeting at the Engineers' Club on November 16, at 12:15 p.m.

District of Columbia Section—Business meeting at the Cosmos Club on November 17, at 8:15 p.m.

Iowa Section—Annual meeting at Fort Des Moines about November 20, at 3 and 6 p.m.

Los Angeles Section—Dinner and dance in the Terrace Room, Hollywood-Roosevelt Hotel; dinner meeting of the Junior Forum at the University Club on November 11, at 5:30 p.m.

Metropolitan Section—Technical meeting at the Engineering Societies Building on November 18, at 8 p.m.

Northwestern Section—Dinner meeting at the Minnesota Union on November 2, at 6:30 p.m.

Philadelphia Section—Dinner meeting at the Engineers' Club on November 10, at 6 p.m.

Sacramento Section—Regular luncheon meetings at the Elks Club every Tuesday at 12:15 p.m.

Seattle Section—Meeting at the Engineers' Club on November 30, at 8 p.m.

Spokane Section—Luncheon meeting at the Davenport Hotel on November 13, at 12 m.

Tennessee Valley Section—Annual meeting at the Patton Hotel, Chattanooga, on November 7.

Texas Section—Fall meeting at the Rice Hotel, Houston, on November 5 and 6; luncheon meeting of the Dallas Branch at the Dallas Athletic Club on November 2, at 12:10 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on November 9, at 12:15 p.m.

Utah Section—Dinner meeting at the Beau Brummel Restaurant on November 4, at 6:30 p.m.

West Virginia Section—Technical meeting at the Frederick Hotel on November 20, at 8 p.m.

Recent Activities

Central Illinois Section

On September 21 the Section sponsored a special meeting, which was attended by over 400 engineers. The speakers were John R. Van Pelt, assistant deputy director of the Army Specialist Corps, Washington, D.C., and Commander Thomas White, from the Navy Procurement Division in Chicago. Dr. Van Pelt explained the function of the Army Specialist Corps, pointing out that the Corps is not a part of the combat forces and that it performs for the Army the many tasks that can be done by civilian engineers, thus releasing a large number of trained army men for combat service. After showing motion pictures of the naval engagements near Midway Island and in the Coral Sea, Commander White explained the procedure followed in securing officer personnel for the Navy. He stressed especially the need of men with electrical and mechanical engineering experience. A dinner, at which Section problems were discussed, preceded the technical program.

Colorado Section

The principal speaker at the September meeting of the Colorado Section was Capt. Arthur J. Becker, chief air warden of the city and county of Denver. Captain Becker gave a talk on the civilian defense organization in Denver, explaining that the city is divided into zones, each commanded by an air-raid warden. He emphasized the fact that a large part of London might have been destroyed during the blitz of 1940 had it not been for the efficient work of 33,000 auxiliary civilian firemen. Ralph Parshall then described some interesting incidents that have made small communities conscious of war and the need for civilian defense. A few remarks on the civilian-defense situation in Baltimore—made by Director G. J. Requardt—completed the program.

District of Columbia

There was a capacity audience of over a thousand present at the September meeting of the Section, which took the form of a joint session with the District of Columbia group of the American Chemical Society. The drawing card was a talk on the "Manufacture and Use of Synthetic Rubber"—presented by Frank A. Howard, president of the Standard Oil Development Company, of New York. Mr. Howard illustrated his lecture with a colored motion picture and demonstration, on laboratory scale, of the steps involved in the manufacture of synthetic rubber.

Kentucky Section

An innovation was introduced at the fall meeting of the Kentucky Section, which was held in Louisville on September 24. In order to stimulate Junior interest and activities the entire session was turned over to Juniors, who planned and executed every detail. Even the speakers were Juniors. Through the courtesy of Col. Henry Hutchings, Jr., district engineer for the Louisville District of the U.S. Engineer Department, Nicholas General Hospital was opened to the group for an afternoon inspection trip. A short talk by Lieutenant West, assistant area engineer, preceded the tour, which took in representative buildings in the group. The entire project consists of 130 buildings on 120 acres. Following a dinner in the evening, numerous business matters were discussed. Later there were talks by H. C. Hickerson, of the Louisville District of the U.S. Geodetic Survey, and Arthur W. Mills, assistant engineer for the U.S. Engineer Department at Louisville. The former discussed opportunities for the civil engineer in the Army, Navy, Marines, and Coast Guard, while Mr. Mills' subject was "Two Years of War Construction for the World's Greatest Technical School." President Blackman closed the meeting with a short talk congratulating the Juniors on their successful program.

LOS ANGELES SECTION

On September 9 members of the Los Angeles Section were guests of the Student Chapter at the University of Southern California. Members of the Chapter conducted the guests about the engineering buildings and various laboratories. The speaker of the evening was Walter Robb, for many years *Chicago Daily News* correspondent in Manila. Mr. Robb discussed the history and possible future of the Philippines, pointing out that all of the islands' early commerce with Spain was by way of California and Mexico rather than through the Indian Ocean. Two motion pictures—showing the construction of M-3 tanks for the U.S. Army and the activities of the TVA in constructing flood-control projects—concluded the program.

MARYLAND SECTION

A lecture on "Plastics—Engineering Properties and Applications" was the feature of the September meeting of the Maryland Section. This was given by Dr. R. K. Witt, associate in chemical engineering at the Johns Hopkins University, and his assistant, C. E. Thompson. Dr. Witt briefly reviewed the various types of available plastics and, with the aid of slides, compared their physical properties. Recent developments in the use of plastics were also discussed and illustrated by samples. An enthusiastic open forum followed his talk.

MID-MISSOURI SECTION

The Mid-Missouri Section held its summer meeting on August 22. Following a dinner John Q. Adams, professor of geography at the University of Missouri, spoke on the subject, "Geographic Exploration in the Alaska Highway Country." Professor Adams' personal knowledge of Alaska made his talk doubly interesting. William J. Schulteen was appointed secretary-treasurer to fill the term of Raymond W. Brooks, who has resigned.

PANAMA SECTION

At the July meeting of the Section, L. F. Harza, Chicago consultant, spoke on "The Uruguayan Power Situation." Mr. Harza, who was en route home from a trip to Uruguay where he served the government in a consulting capacity, discussed the engineering problems in connection with the completion of the main hydroelectric development in that country.

SACRAMENTO SECTION

Speakers at the September meetings of the Sacramento Section were Milo S. Farewell, who discussed the "Preservation of Metal Structures in Contact with Earth or Water"; Ralph S. Wadsworth, director of the U.S. Employment Service, who spoke on "The Manpower Program for War Industries and Agriculture"; T. E. Stanton, Vice-President of the Society, who gave a résumé of the Local Sections Conference at Minneapolis; and M. J. Brickley, professor of history at Sacramento Junior College, whose subject was "Russia and the War." On one occasion a sound motion picture entitled "Excursions in Science," was shown through the courtesy of the Pacific Electric Company.

SAN DIEGO SECTION

The dinner meeting, held on September 24, was devoted to discussion of "Construction Problems of the Interceptor Sewer and Disposal Plant." Original plans for this plant, now being constructed by the city of San Diego, called for two digesters. Since the drawing of the original plans, however, there has been a tremendous increase in the population and development of the city, causing the size of the plant to be increased 30%. Connecting the plant is an interceptor sewer line approximately seven miles in length, varying from 15 to 60 in. in diameter. The line follows the edge of San Diego Bay and is placed 26 ft below the graded surface of the street. Installation was by tunneling, jacking, and open ditch, and water was encountered during the entire seven miles of construction.

TACOMA SECTION

During the September dinner meeting of the Tacoma Section F. M. Veatch reported on the Annual Convention in Minneapolis. Later in the evening there were talks on the engineering aspects of the design and construction of the LaGrande and Alder dams and tunnels, now being constructed as part of the Second Nisqually Power Project for the city of Tacoma. The speakers were C. E. Pearce and R. F. Bullard, who are engaged on the work. Mr. Pearce is head civil and hydraulic design engineer for the Tacoma Light Department.

TENNESSEE VALLEY SECTION

The Chattanooga Sub-Section commenced the fall season with a chicken dinner, followed by a business meeting and technical session. The latter program consisted of a talk by Dr. Irvine W. Grote, who discussed the chemicals and materials used in modern warfare. Chattanooga was the scene, also, of a special meeting of the Tennessee Valley Section, which was held on September 24. This meeting, which was a joint session with local groups of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the American Institute of Chemical Engineers, was devoted to discussion of war subjects. Among the speakers were Colonel Kendrick, post engineer at Fort Oglethorpe, who explained the problems confronting a post engineer; and Captain Cureton, of the Army Specialist Corps, who explained the duties of a "specialist" in the Corps.

A symposium on "Cavitation in Hydraulic Structures and Machines" was the feature of the September meeting of the Knoxville Sub-Section. Those participating in the forum were R. M. Riegel, J. F. Roberts, G. H. Hickox, and G. R. Rich. All are on the engineering staff of the Tennessee Valley Authority.

WEST VIRGINIA SECTION

Members of the West Virginia Section met at Charleston on the afternoon and evening of September 25. Both sessions were attended by about fifty members of the West Virginia Society of Professional Engineers. Speakers at the afternoon meeting were C. S. Duncan, chief economist for the Association of American Railroads in the Bureau of Railway Economics, Washington, D.C., who spoke on railway transportation in wartime; C. C. Whittelsey, chief engineer for Ford, Bacon and Davis at Charleston, who discussed his recent experiences as engineer in charge of the construction of a synthetic rubber plant; and R. P. Davis, dean of the college of engineering at West Virginia University, whose subject was "Developments in Engineering Education for Wartime Training." During a brief business session the following officers were elected for the coming year: George W. McAlpin, president; W. O. McCluskey, Jr., vice-president; and J. N. Wallace, secretary-treasurer. At the dinner session E. A. Holbrook, dean of the college of engineering at the University of Pittsburgh and president of the National Society of Professional Engineers, spoke on "The Place of the Engineer." He was followed by F. A. Muhlenberg, colonel, Corps of Engineers, U.S. Army, who discussed the war effort and explained ways in which men and women not in actual combat service can help. "In order to win America must have the aid of every citizen," Colonel Muhlenberg emphasized.

WISCONSIN SECTION

An inspection trip to the yards of the Manitowoc Shipbuilding Company at Manitowoc, Wis., preceded a dinner meeting of the Section on September 23. Company representatives conducted the members and a large number of guests through the yards, where submarines and invasion barges were in the process of construction. The various shops, where the plates and pipes are made, were also visited. Later in the evening A. L. Pitz, vice-president and general superintendent of the company, discussed some of the problems involved in submarine building. Earl Walter, city engineer of Manitowoc, arranged the program and inspection trip.

Student Prizes Awarded

At the end of each school year many of the Society's Local Sections present awards to engineering students graduating with high scholastic distinction from schools and colleges within their territories. The awards vary, consisting generally of payment of the recipient's initiation fee as a Junior in the Society and, in some instances, of his dues for a year. In all cases, of course, the awards are contingent on the favorable action of the Board of Direction upon the recipient's application for membership. The Society has been notified of the following prize winners for 1942:

Name of Student	College	Local Section Giving Award
John M. Johnson	University of Arizona	Arizona
Elwin H. King	University of Illinois	Central Illinois
Arthur N. May		
James A. Porter		
Norman E. Bradstock	Ohio State University	Central Ohio
Robert C. Sale	University of Cincinnati	Cincinnati
Charles Smallwood, Jr.	Case School of Applied Science	Cleveland
Alfred L. Opdycke	Ohio Northern University	
Murray E. Manley	Colorado State College	Colorado
Charles F. Dwyer	University of Colorado	
Malcolm G. Andrews	University of Connecticut	Connecticut
Arthur B. Harding	Yale University	
Louis Cattaneo	Catholic University of America	District of Columbia
Walter R. Douglas	George Washington University	
Oliver M. Carter, Jr.	University of Florida	Florida
Hugarwyn Quillian	Georgia Sch. of Technology	Georgia
C. L. Peacock		
James R. Brown	Rose Polytechnic Institute	Illinois
Earl Huxhold	Illinois Institute of Technology	
Edward M. McMillan	Northwestern University	
William H. Munse	University of Iowa	
Laddie L. Stahl	Purdue University	
Jesse E. Fant	Purdue University	Indiana
Thomas W. Yoder		
Harold E. Bowsher	Rose Polytechnic Institute	
Ray K. Chalfant, Jr.		
Victor E. Greimann	Iowa State College	Iowa
Warren F. Burger	State University of Iowa	
David W. Milhan	Cornell University	Ithaca
John G. McEntyre	Kansas State College	Kansas
Horace C. Lamberton	University of Kansas	
Albert J. Spare, Jr.	University of Kentucky	Kentucky
Earl H. Schaaf	University of Louisville	
William H. Krantz	Lafayette College	Lehigh Valley
Robert E. Ashley	Lehigh University	
Heber R. Norckauer	Louisiana State University	Louisiana
James P. Ewin, Jr.	Tulane University	
Gordon P. Fisher	Johns Hopkins University	Maryland
Fred Shulman	University of Maryland	
Stanley W. Beer	Brooklyn Polytechnic Institute	Metropolitan
David S. Donald	Newark College of Engineering	
James F. Fawls	Manhattan College	
George Gordon	Rutgers University	
John C. Hagedorn	Cooper Union	
John F. Stolz	College of the City of N.Y.	
Arthur Tauscher	New York University	
Norman E. Tilden	University of Nebraska	Nebraska
Byron R. Magruder	New Mexico State College	New Mexico
Arthur V. Dienhart	University of Minnesota	Northwestern
Wallis H. Sargent		
(Miss) Margo Whelan		
Eugene J. Guldemann	North Dakota State College	
Kendall C. Fox	University of North Dak.	
Harold J. Downes	South Dakota School of Mines	
John C. Salmon	South Dak State College	
Michael H. Donahey	Oregon State College	Oregon
John T. Merrifield		
Arthur E. Olsen		
Louis N. Laushey	Pennsylvania State College	Philadelphia
Joseph C. Whiteman	University of Delaware	
Ervin Spindel	Drexel Institute	
John T. O'Brien	Carnegie Institute of Technology	Pittsburgh
Carl W. Lawton	Clarkson College of Technology	Rochester
Harold Johnson	University of Nevada	Sacramento
Mark W. Beard	Missouri School of Mines	St. Louis
William M. Harting	Washington University	
Henry M. Reith		
Harold E. Camping	University of California	San Francisco
Francis C. Nash	University of Santa Clara	
Charles B. Lusk	Stanford University	
Charles M. Day	University of Washington	Seattle
George B. Anderson	The Citadel	South Carolina
Francis M. Hinson, Jr.	University of S. Carolina	
James M. Rabb	Clemson College	
Robert E. Smith	University of Idaho	Spokane
Harold F. Sitts	Washington State College	
Clyde Johnson	Syracuse University	Syracuse
Edward M. Dougherty	University of Tennessee	Tennessee Valley
George D. Reager		
Preston N. Olsen	Utah State Agricultural College	Utah
Dean S. Storrs	University of Utah	
Sherwood A. Sulton	Virginia Poly. Institute	Virginia
Charles E. Bowers	University of Wyoming	Wyoming
Murray D. McLaughlin		

Other awards of Junior membership in the Society include the Milo S. Ketchum Award, made by the civil engineering department at the University of Colorado, to Elmer T. Punshon, of the University of Colorado. In a competition for a cash prize, conducted by the Cleveland Section, the award went to John J. Cumming, of Akron University. The Robert H. Simpson Prize of $25 in cash—donated by Mrs. Robert H. Simpson in memory of her husband, the late Robert H. Simpson, M. Am. Soc. C.E.—was won by Richard C. Kennedy, of Ohio State University. The latter award is administered by the Central Ohio Section.

Student Chapter Annual Reports

Abstracts of 1941–1942 Reports from the Western and Northern Districts as Provided by the Society's Committee on Student Chapters. Abstracts from Other Districts Are Scheduled for the December Issue

CORNELL UNIVERSITY

This has been one of the most active and successful years in the history of the Cornell Chapter. We began the year with a membership drive climaxed by a civil engineering smoker. In the first drive, we got sixty members and before the end of the year had raised the enrolment to ninety-eight.

Besides five interesting meetings, at which we had outside speakers who were outstanding authorities in their respective fields, we planned and carried out a series of luncheons and panel discussions. In this way the students could really take part in the discussions, and the programs proved very popular. Enlargement of our Chapter newspaper, *The Rivet*, is planned for next year.

UNIVERSITY OF CINCINNATI

Members of the University of Cincinnati Chapter held a number of 15 or 20-minute meetings at noon, several dinner meetings, and a picnic. At one of the most entertaining meetings, Dr. David B. Steinman, New York consultant, spoke on aerodynamic instability in connection with the fall of the Tacoma Narrows Bridge. His models, made of cardboard and wood, behaved amazingly in the draft from an electric fan. Dr. Steinman held 200 engineers completely absorbed for over two hours. In fact, two of the Student Chapter members were so impressed that they prepared models similar to Dr. Steinman's to demonstrate on Co-Op Day. The Chapter has also been active in intramural sports.

ILLINOIS INSTITUTE OF TECHNOLOGY

One of the most interesting events of the 1941–1942 school year was the Student Conference held in Chicago during the Fall Meeting of the Society. The Student Chapters at Illinois Institute of Technology and Northwestern University were co-hosts to the visiting Chapters, and there was an interesting program of technical and social events. An inspection tour of the nearly completed Chicago subway was enjoyed by the delegates, the group being taken on a tour of the railway tubes underlying the Loop streets. The entire membership of the Student Chapter attended the

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MEMBERS OF CARNEGIE INSTITUTE CHAPTER
Investigating Behavior of a Timber Girder

eleven general sessions of the Midwest Power Conference held in Chicago in April. On that occasion they heard Leland Olds, chairman of the Federal Power Commission, speak.

CARNEGIE INSTITUTE OF TECHNOLOGY

Weekly Student Chapter meetings were the rule at the Carnegie Institute of Technology during the past year. There were twenty-eight such sessions, in addition to eight field trips to points of engineering interest. The war has caused an expedited program for upper classmen. Seniors graduated a month early; juniors started their senior-class work early in June and will graduate in January. This program will help to meet the ever-increasing demand for engineers.

CLARKSON COLLEGE OF TECHNOLOGY

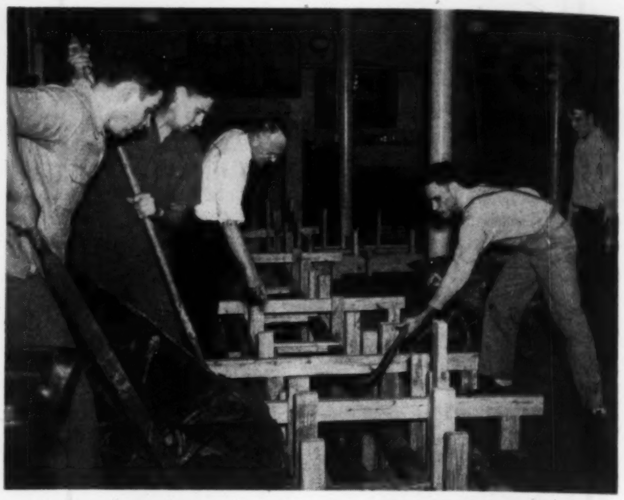
The program of the Clarkson College Chapter included an interesting discussion on dam construction by Major Purcell, head of the R.O.T.C. unit at the college, and three talks by outside speakers. At the annual banquet, a former graduate of the college gave an entertaining talk on the St. Lawrence Seaway Project and showed a colored film of an inspection tour up the St. Lawrence.

CASE SCHOOL OF APPLIED SCIENCE

In forwarding the annual report on Chapter activities, Prof. Geo. E. Barnes, Faculty Adviser at the Case School, comments as follows: "The effect of the year's activities by the Student Chapter has been good—morale and interest are high. The year has been an extraordinarily busy one for the Chapter, despite the extraordinary demands on student time which results from our accelerated program and shortened year. This, I think, made the very successful handling by the students of the North Central Student Chapter Conference the more praiseworthy. The papers by the students at this conference were excellent, and I am certain that the visiting students were well cared for and that the program, particularly inspection of the harbor and river works, was enjoyable for all."

UNIVERSITY OF DAYTON

The Student Chapter takes pride in the genuinely friendly relationship existing between itself and the Dayton Section. The joint meeting with the Section and the Dayton chapter of the Ohio Society of Professional Engineers was a great success. Loran D. Gayton, assistant city engineer of Chicago, was guest speaker of the evening. Mr. Gayton stated that he was delighted at the initiative displayed by the Student Chapter and that his appearance at the joint meeting was a tribute to the fine spirit displayed by the Chapter delegates at the Fall Meeting of the Society in Chicago. At least two students attend each of the monthly meetings of the Section, and these monthly contacts help to develop in the students a professional attitude.



UNIVERSITY OF DAYTON CHAPTER COOPERATES IN CONSTRUCTING CONCRETE CHANNELS IN NEW HYDRAULICS LABORATORY

MEMBERS OF UNIVERSITY OF DETROIT CHAPTER WITH FIELD SECRETARY JAGGER

UNIVERSITY OF DETROIT

At the University of Detroit the college of engineering is operated on a cooperative basis, school periods alternating with work sessions every four weeks. This makes it difficult to set dates for Student Chapter meetings which will be agreeable to all, and this is especially true under war conditions. However, the Chapter has functioned well, and there was much interest shown by the members. There were two inspection trips through the Ford bomber plant at Willow Run, Mich. These tours were intensely interesting since they gave the students an opportunity to see the largest plant of its type in the world while it was still in the construction stage. At the airport which adjoins the plant a million square yards of concrete were used in the runways alone.

University of Illinois

An innovation in the affairs of the University of Illinois Chapter is the newly adopted rating system. This takes the form of a record in two parts. The first is a tabulated record of attendance at all meetings (lectures, smokers, dinners, and conventions) compiled from a signed record of attendance for each meeting with the exception of dinners. The attendance at the latter is checked by ticket sales. The second part of the report consists of the president's confidential record of the amount and type of work done by the various committee members. This report is used by the nominating committee in considering candidates for Chapter offices. In addition, the report is used by the faculty in making certain awards to senior-class students.

Marquette University

There were seven meetings of the Marquette University Student Chapter during the year. At six of these, talks were given by able speakers on various topics of interest to the engineering students. In place of the regular meeting in January, a bowling party was much enjoyed. All but one of the senior-class members entered the armed forces immediately after graduation, which is a matter of pride to the Marquette Chapter.

Michigan College of Mining and Technology

The Chapter reports an interesting and enjoyable year. It has been active in campus activities and has had excellent cooperation from its members. With the financial aid contributed by Clare Johnston the Chapter sent four delegates to the Regional Student Conference at Chicago, four delegates to the Regional Student Conference at the University of Wisconsin, and two delegates to the student state section meeting held at Michigan State College. As our exhibits for the Michigan Tech Engineering Show we entered working models of a sewage disposal plant and an alternating siphon. Our efforts attracted much favorable attention.

Iowa State College

The Chapter president reports that, "The year 1941–1942 has been one of the most successful in the annals of the Chapter. In spite of the accelerated scholastic program here at the college, students found time to attend meetings and conferences as well as, or better than, in previous years. . . . The regular meetings of the Chapter which were held about every other week were of a technical or semi-technical nature and included local and out-of-town speakers as well as student presentations of Society slide lectures and motion pictures. The social functions consisted of our Fall Round-up (a picnic), our winter smoker, and a banquet in the spring. In addition, the Chapter officers met once a week to discuss current problems and to plan future meetings. These cabinet meetings were kept to a maximum length of an hour and were very useful in keeping all the officers and committee heads in touch with each other. . . ."

"Come and Get It"
The 1941 Round-Up at Iowa State College

Syracuse University

During the year the Chapter had no outside speakers, the programs being devoted to student and faculty talks and the showing of the Society's illustrated lectures. At one session motion pictures on aerial photography were shown, and Professor Clunch, faculty member and expert in the field, discussed the subject. In April the Chapter was host to the Northern New York Regional Conference of Student Chapters.

University of Michigan

In order to obtain as much cooperation as possible, the officers of the University of Michigan Student Chapter assigned two or three members to write up each meeting for the Annual Report. We feel that the publication of a Chapter paper such as our *Bulldozer* is one of the best ways of keeping members actively interested in the Chapter. Our system of selecting a publications committee and rotating the editorship so that each member of the committee has the opportunity to prepare an edition has also worked well. Since the editors gave assignments to various members of the Chapter, a large number took an active part in the publication. In planning the meetings for the past year, an effort was made to arrange programs which would give the members a practical insight into the problems encountered by engineers in actual practice.

Time Out for a Smoke
University of Michigan Chapter Has Its Annual Picnic

Northwestern University

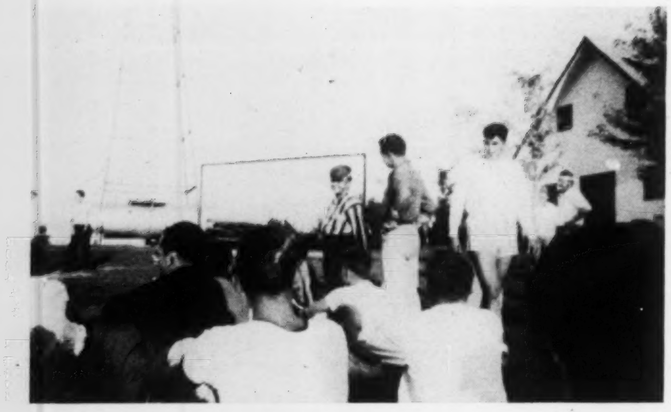
With the advent of the new Technological Institute, the membership of the Chapter promises to expand greatly, thereby allowing an increase in activities and a better representation at coming meetings. Many small meetings, at which the needs of the Chapter were discussed, were held during the year. One of our main events was the two-day field trip to Dubuque, Iowa, during Christmas vacation. En route we stopped at Grand Detour, Ill., to look over a bridge job where a cofferdam was under construction. At Dubuque we inspected the piers for the new bridge which is to span the Mississippi. At the Fall Meeting of the Society in Chicago, at the beginning of the academic year, we were hosts along with the Illinois Institute of Technology for the Student Conference.

Ohio Northern University

The Chapter felt highly honored at having won the Man-Mile Trophy awarded by the North Central Student Conference at the meeting held in Cleveland. Fifteen members of the Ohio Northern Chapter attended the conference, and the junior delegate, James Switzer, was chosen secretary-treasurer for the 1942–1943 conference. The Chapter was also well represented at the Fall Meeting of the Society, having six members in attendance. The Chapter reports a very successful year. Interest in the twenty meetings held was evidenced by 100% voluntary attendance.

Ohio State University

One of the high lights of the fall semester was a joint meeting with the Central Ohio Section. This was an especially happy occasion since it marked the twentieth anniversary of the Section. The dinner was complete with birthday cake and candles, the cake being subsequently raffled off at ten cents a chance and the proceeds given to the Chapter. The past year witnessed a distinct improvement in the quality of our Chapter publication, the *A.S.C.E. News*. The retiring editor has done an excellent job of reviving the News and of obtaining articles of interest.



SOFTBALL GAMES ARE POPULAR
Scene at Ross Camp at Purdue University

PURDUE UNIVERSITY

This year most of our lectures were given by members of the civil engineering faculty, many of whom were connected with defense work during the summer. The annual banquet, at which Secretary Seabury spoke on "The Outlook for Graduating Engineers," was thoroughly enjoyed by all. It was a joint meeting of the Indiana Section, the Rose Polytechnic Chapter, and our own. The senior inspection trip was of unusual interest. We arrived in Chicago in time to attend the Fall Meeting of the Society on October 15th, a Student Chapter meeting in the morning, and a symposium in the afternoon. Most of the next three days was spent in inspecting the subway, the South Side Sewage Disposal Plant, and other points of interest to engineers.

PENNSYLVANIA STATE COLLEGE

The Pennsylvania State College Chapter reports that its policy of covering a different field of civil or sanitary engineering at each meeting was continued this year with interesting results. Programs treated such diverse topics as contacts in engineering; student summer employment; military engineering; suspension bridge construction; uses of brick in construction; water supply and public health; bridge failure; and water hammer. Under the sponsorship of the Chapter, a part of the main engineering building was set aside as a place for the use of the civils during their free hours. *The Tripod*, now in its thirteenth year of publication, was edited by the executive committee of the Chapter. The Chapter is proud of its publication.

STATE UNIVERSITY OF IOWA

As usual each member of the Chapter had at least one opportunity during the past year to prepare and present a paper at a Chapter meeting. Subjects chosen were either on some phase of the student's practical experience outside of college or, lacking such experience, on some subject in which personal interest was a stimulating factor. Six outside speakers added variety and interest to the programs. There were twenty-four meetings.

UNIVERSITY OF MINNESOTA

In addition to several interesting meetings at which movies on bridge construction and railroading were shown, the Chapter sponsored a "bean feed." The speaker at the latter event was Warren DeLapp, mathematics instructor at the university. His subject was "Engineering in South America." The annual picnic drew the largest turnout of the year. It was held at Spring Park, and the members enjoyed games of baseball and volley ball and horseshoe pitching.

UNIVERSITY OF PITTSBURGH

The executive board of the Chapter has tried to set up an organization that would act not merely as another classroom but would also provide social and athletic events for the diversion of its members. We have cooperated fully with the intramural program at the university. We had, at times, a touch-football team and a mushball team. We have not, however, neglected our contacts with the other Student Chapters. The Northwestern Student Chapter Conference was attended by eight of our students. Our seminars were interesting and, in all, it has been a very successful year for the Chapter.

ROSE POLYTECHNIC INSTITUTE

With a membership of twenty-five out of a total of twenty-six eligible students, the Rose Polytechnic Chapter enjoyed another successful year. The programs were interesting and instructive. On one occasion we sponsored a meeting to which the entire student body was invited. Two prominent engineers gave short talks describing the water filtration plant at Chicago, a motion picture being shown to illustrate the processes of construction.

UNION COLLEGE

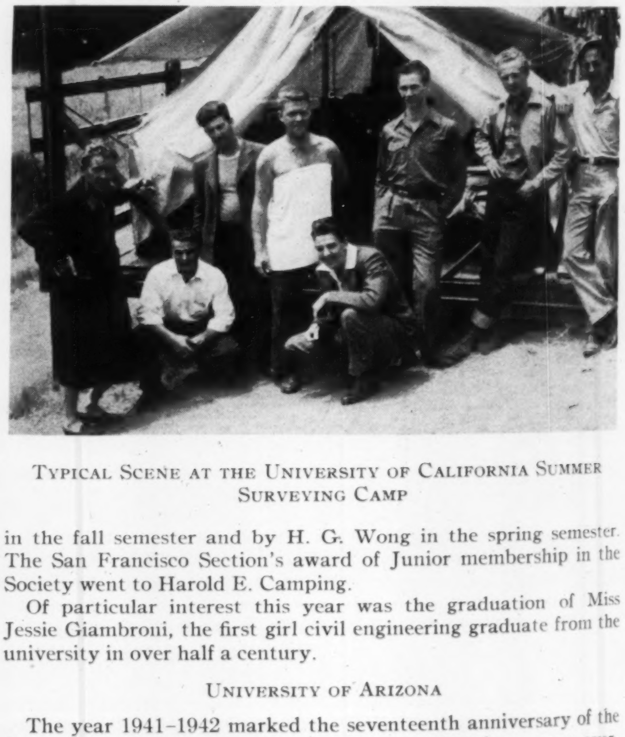
A novel outdoor meeting initiated the Chapter activities for the year. It was held at the Duane Lake home of our Faculty Adviser, Professor Taylor. The meeting followed an enjoyable picnic supper prepared by the wives of the civil engineering faculty. Another meeting that will be remembered with special pleasure was a joint affair with students from the local chapter of the American Institute of Electrical Engineers. Pictures of Grand Coulee Dam were shown, with emphasis on the practicability of the conveyor belt system for moving huge amounts of materials. A general discussion concluded the meeting.

UNIVERSITY OF WISCONSIN

The University of Wisconsin Student Chapter enjoyed a very successful and busy year. There were thirteen meetings, including an enjoyable joint meeting and banquet with the Marquette University Chapter and the Wisconsin Section, our Chapter acting as host. At one of the best-attended meetings of the year, the moving picture of the failure of the Tacoma Narrows Bridge was shown. The First Annual Mid-Western Regional Conference of Student Chapters was the major undertaking of the year, and the results showed how seriously the University of Wisconsin Chapter took its responsibilities as host.

UNIVERSITY OF CALIFORNIA

The University of California Chapter has had a busy year, with seven regular meetings and interesting field trips. Its numerous other activities include publication of *The Civil-Cal*, which merits special mention. To promote interest in its activities, the Chapter awards a prize each semester to the student who brings in the greatest number of new members. This was won by H. Kellam in the fall semester and by H. G. Wong in the spring semester. The San Francisco Section's award of Junior membership in the Society went to Harold E. Camping.



TYPICAL SCENE AT THE UNIVERSITY OF CALIFORNIA SUMMER SURVEYING CAMP

Of particular interest this year was the graduation of Miss Jessie Giambroni, the first girl civil engineering graduate from the university in over half a century.

UNIVERSITY OF ARIZONA

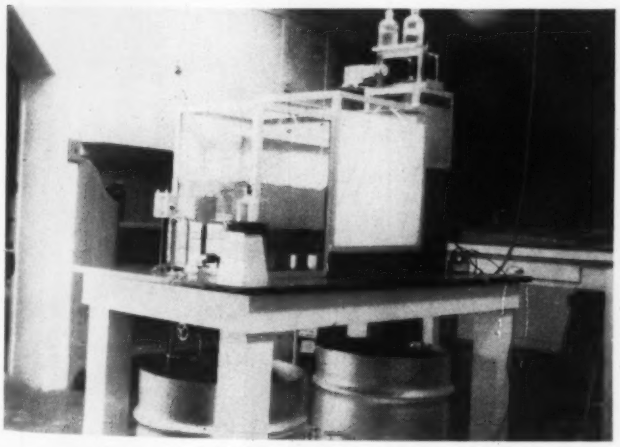
The year 1941–1942 marked the seventeenth anniversary of the University of Arizona Chapter. It proved to be a year over-

Members of the University of Colorado Student Chapter

shadowed with unforeseen events—our country's entrance into the world conflict and the death of our Faculty Adviser, Prof. Frank C. Kelton. Although greatly handicapped by these circumstances, our organization managed to offer its members a comparatively full and varied program. The activities included inspection trips, attendance at the fall meeting of the Arizona Section, interesting sound pictures, student papers, the annual picnic, and the spring meeting with the Arizona Section. One of the features of the latter event was the award of Junior membership in the Society to John Johnson, president of the Chapter.

California Institute of Technology

A high light of the past year has been the close contact enjoyed by our Chapter with the Los Angeles Section and its members. The Chapter is greatly indebted to Mr. Macy Jones and Prof. Franklin Thomas for their untiring efforts to promote these cordial relationships, and it would like to bring their fine work to the attention of the Society. The activities of the Chapter were as a rule eagerly supported by the largest and most enthusiastic membership in a number of years. An informal buffet supper at the home of Maj. Gen. Lansing H. Beach and the annual joint meeting with the Los Angeles Section on the local campus constituted two of the year's most interesting and enjoyable programs.



The Engineers' Show at the University of Idaho
Model Filtration Plant Displayed by the Student Chapter

University of Colorado

With the academic year of the university rapidly drawing to a close, we pause for a moment's reflection upon the events of the past school year. The national emergency has knit the students more closely together within student organizations. It has been our aim, in the short time allotted for activities, to attempt to instill in members a social as well as a professional attitude. To this end we participated in the Annual Rocky Mountain Highway Conference, attended the Regional Student Chapter College at Fort Collins, and made several inspection trips. There were student papers on a wide variety of subjects, with two of the best of these appearing as feature articles in *The Colorado Engineer*. Thus, as we conclude the twenty-second year of Chapter activities, we have many fond memories and are already planning for an even better year in 1942–1943.

University of Kansas

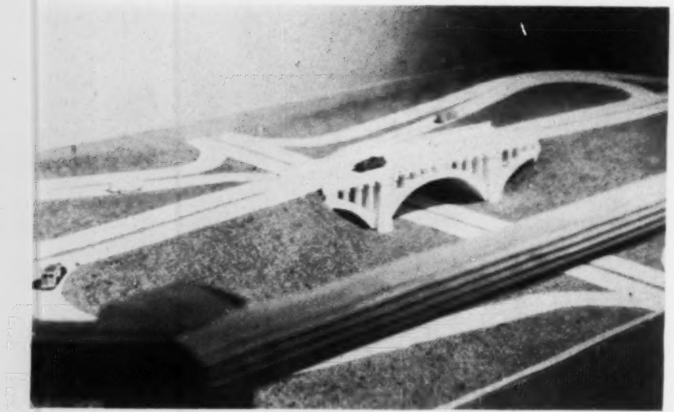
Although membership in the University of Kansas Student Chapter is entirely voluntary, it has increased considerably in the past school year. In fact, the percentage of membership was the largest in the history of the Chapter. The meetings were characterized by the active participation of all present and lively open forums. It was found that motion pictures were especially effective drawing cards. The genuine interest of the members is indicated by the relatively large number attending the Mid-Continent Conference at Manhattan (Kans.) and the joint meeting with the Kansas Section at Topeka.

University of Nebraska

In spite of military activities which interfered somewhat with meetings, the past year was a profitable one for the University of Nebraska Chapter. One of the most interesting of the eight meetings held was a joint session with the Nebraska Section. In addition, the Chapter heard six outside speakers, saw several films, and concluded the year with an enjoyable dinner meeting.

University of Idaho

The program of the University of Idaho Chapter for the 1941–1942 school year included a number of lectures by instructors and men outstanding in the profession. An inspection trip to Grand Coulee Dam proved highly valuable to the members, as did joint meetings with the Student Chapter at Washington State College. Picnics with the faculty members did much to promote cordial relationships between the two groups. In all, the students feel they have gained a wealth of good from their membership in the Chapter.



MODEL OF CLOVERLEAF INTERSECTION

Shown by Kansas State Chapter at Annual "Open House"

KANSAS STATE COLLEGE

The high light of the many activities of the Chapter this year was being host to the Second Annual Mid-Continent Conference of Student Chapters. In connection with the annual inspection trip sponsored by the Chapter twenty-one senior-class members attended the Fall Meeting of the Society in Chicago. This trip inspired many in the Chapter with the desire to participate in future activities of the Society. Outside speakers addressed the regular bimonthly meetings, and a smoker in the fall and barbecue in the spring enhanced the program of activities.

This year the Chapter was fortunate in winning for the second successive time the gold trophy for having the best exhibition at the annual Engineers' Open House held on the college campus. The numerous models of engineering structures built by the students took first place in this competition.

COLORADO STATE COLLEGE

During the past school year the two outstanding events on the Colorado State College campus were Engineers' Day and the Conference of Student Chapters. The latter event brought together Chapter representatives from the University of Wyoming, the University of Colorado, the Colorado School of Mines, and Colorado State College. A field trip to the airport and to the Big Thompson Diversion Project was arranged for the visiting students. Dinner at the Student Union and an address by Mr. Wilmer McMillin ended a profitable day.

At the twelve meetings held during the year, four papers were presented by students, three by faculty members, and three by outside speakers. Moving pictures illustrated the papers, and talks added to the interest of the meetings.

MONTANA STATE COLLEGE

During the past school year there were twenty-six meetings of the Montana State College Student Chapter. Papers by the students constituted the greater part of the programs, though the Society's illustrated lectures were also enjoyed. Two outside speakers were heard during the year.

UNIVERSITY OF NEVADA

During the fall semester of the past school year the Student Chapter had four meetings, which were addressed by outside speakers. In October there was a joint dinner meeting in Reno with the Sacramento Section of the Society. The four meetings held during the spring semester featured talks by the student members. At the final session in April the Sacramento Section awarded its annual prize of Junior membership in the Society to Harold Johnson, of the University of Nevada. The Chapter won second place for its exhibits in the annual Engineers' Day celebration.

UNIVERSITY OF NORTH DAKOTA

The University of North Dakota Chapter has completed an enthusiastic year. Because of the war speakers were hard to obtain, but the meetings were made interesting by student talks supplemented by films and lantern slides. High points of the year were the annual Engineers' Day, for which the Chapter prepared an interesting exhibit, and the joint meeting and banquet with the North Dakota State College Chapter at Fargo, N. Dak.

UNIVERSITY OF SOUTHERN CALIFORNIA

Chapter meetings during the first semester were devoted solely to business and to organization problems. During the second semester the Chapter heard several outside speakers, saw slides and motion pictures of the collapse of the Tacoma Narrows Bridge, and visited the U.S. Engineers' Office at Glendale, Calif. Social events included a dance sponsored by the Chapter.

STANFORD UNIVERSITY

Field trips to the Moore Drydock Company at Oakland and the Union Square Garage in San Francisco were high lights of the fall semester. There were also two meetings with the San Francisco Section. The spring program featured a field trip to Shasta Dam made during the spring vacation. A field trip to the Richmond shipyards gave first-hand information on the present shipbuilding program. On one occasion the Chapter was host to the Santa Clara Chapter at a joint meeting on the Stanford campus, discussion centering about the timely subject of "The Young Engineer in the Army."

In addition to the above meetings, on the lighter side, the Chapter was active in intramural sports, and sponsored a joint picnic with the local student groups of the mechanical engineers. The annual barbecue for members, faculty, and wives concluded the year's activities.

MEMBERS OF STANFORD UNIVERSITY CHAPTER AT INITIATION BANQUET

Members of the Student Chapter at Texas Agricultural and Mechanical College

Texas Agricultural and Mechanical College

The past year has been one of the busiest in the history of the Chapter. We sent representatives to the fall meeting of the Texas Section in Fort Worth; to the spring meeting in Austin, where one of our members was elected secretary-treasurer of the student convention for the next year; and to the Fall Meeting of the Society in Roanoke, where our delegation won a twenty-dollar prize for the most man-miles of travel.

In addition to the six regular meetings, at which outstanding engineers were the speakers, there were student talks and interesting films. The Chapter sponsored a dinner dance, a barbecue, and an annual banquet. Col. Willard Chevalier, vice-president and director of the McGraw-Hill Publishing Company, was the speaker. The Chapter also took part in the annual Engineers' Day Show, which is the high light of the year for the engineering societies.

New Mexico State College

Student papers comprised the programs at the thirteen Chapter meetings held during the past school year. There was one outside speaker, and one joint meeting with the University of Arizona Student Chapter.

Southern Methodist University

There were thirteen Chapter meetings during the year, the programs consisting largely of the presentation of student papers, though there were also talks by five practicing engineers. The Chapter had two joint meetings with the Dallas branch and sent delegates to the fall and spring meetings of the Texas Section. At the latter session a paper presented by Paul O'Rourke, Student Chapter member, took second place in a competition open to students from all the other Chapters in the state. An inspection trip to the Fort Worth Aircraft Assembly Plant was one of the high lights of the year.

South Dakota State College

At the meetings held during the past year the program consisted of the showing of films obtained from various firms, reports by student and faculty members, and illustrated lectures by outside speakers. An outstanding event of the year was the annual Engineers Week, in which the Chapter participated. For our dinner meeting, we were fortunate in having as guest speaker Henry Penn, district engineer at Chicago for the American Institute of Steel Construction. We feel that the past year has been a highly successful one, much enthusiasm having been aroused by assigning the students special projects for the various meetings.

Texas Technological College

A smoker held early in the fall for the purpose of gaining members, initiated the year's activities. At the regular meetings four student papers were presented, and on one occasion the Society's Contact Member, Harry N. Roberts, addressed the group. Edwin C. Woodard, president of the Texas Section, spoke on his civil engineering experiences at another meeting. The Engineers' Show, in which the Chapter participated, was a great success, some 5,000 persons viewing the civil engineers' exhibit. A large delegation attended the spring meeting of the Texas Section at Austin.

Oklahoma Agricultural and Mechanical College

A great deal of interest was shown by the student body in the bimonthly meetings of the Chapter. The first meeting of the school year consisted of the usual smoker, held to help the new and old students and the faculty members to get acquainted. The regular meetings were interspersed with other smokers and motion pictures. Special get-togethers included the annual "tea party" held in a local park, and two joint dinner meetings with the Oklahoma Section. There was also an inspection trip to the Midwest Air Depot under construction at Oklahoma City.

University of Oklahoma

Five guest speakers addressed the nine meetings of the University of Oklahoma Chapter. High lights of the year were the joint meetings with the Student Chapter at Stillwater; the annual banquet, at which the members of the engineering faculty spoke; and the joint meeting with the Oklahoma Section in Oklahoma City. On the latter occasion David W. Bardwell received the Section's award of Junior membership in the Society.

Oregon State College

At the regular meetings of the Chapter, which were of an educational nature, selected speakers lectured on subjects dealing with the part the civil engineer is playing in the present conflict. A field trip to the Oregon Shipbuilding Company at Portland proved of great interest and benefit to the students. The big social event of the year was the Engineers' Bust, at which the Chapter was awarded second place for a skit it presented. Several of the Chapter members were active on committees for the Engineers' Dance. Other social functions sponsored by the Chapter were a picnic, breakfast, and banquet. Thus the past year was a busy and successful one for the Chapter.

The Rice Institute

The 1941–1942 school year got off to a good start. The meetings were well attended, and at each meeting there was a student paper prepared in advance by one of the members and formally discussed by three or four others. Topics were chosen with the approval of the Faculty Adviser, the papers usually dealing with the summer work of the speaker. The semi-annual meetings of the Texas Section were used as a guide for the conduct of these sessions. This year the secretary of the Chapter was elected president of the Texas Student Chapters at the spring meeting of the Texas Section in Austin.

UNIVERSITY OF SANTA CLARA CHAPTER ON INSPECTION TRIP
Group Views Kilns at the Gladding Clay Pipe and Tile Company, San Jose

UNIVERSITY OF SANTA CLARA

The program for the year included regular semi-monthly meetings; a joint session with the University of Stanford Chapter; participation in meetings of the San Francisco Section; and inspection trips to various points of engineering interest in the San Francisco Bay Area. Programs for Chapter meetings included provision for the presentation of student papers at every other meeting, talks by outside and faculty speakers and moving pictures being scheduled for the intermediate meetings. Two awards were made during the year. The Activity Award, a perpetual trophy, was given to Leonard McCarthy. The San Francisco Section award of Junior membership in the Society, given to the senior showing the greatest promise of being a successful engineer, went to Frank Nash, Student Chapter president.

UTAH STATE AGRICULTURAL COLLEGE

The Utah State Student Chapter had a total of twelve meetings during the year and sponsored several campus activities. A joint meeting with the Ogden (Utah) Engineers' Club, at which the Chapter acted as host, was an outstanding success. There was also a joint meeting with the University of Utah Student Chapter, which was arranged in connection with an inspection and field trip. Other Chapter activities included a smoker for townspeople and students, a radio quiz program, a student assembly program, and the annual canyon party for the graduating seniors.

UNIVERSITY OF TEXAS

Several construction projects were undertaken by the University of Texas Student Chapter during the year. These consisted of improving its bulletin board, the construction of a fence around the sun dial built by the 1940–1941 Chapters, and the reorganization of the Chapter and the adoption of a new constitution and by-laws. There were fifteen meetings, with papers presented by students, faculty members, and outside speakers. More interest was displayed in the meetings than in previous years.

UNIVERSITY OF WYOMING

The eight meetings of the Chapter held during the past year include a joint session with the Wyoming Section of the Society. The Chapter played a prominent part in the activities of the engineering college, including the annual Engineers' Ball. Ten members of the Chapter attended the annual meeting of the Rocky Mountain Conference of Student Chapters, held at Fort Collins, Colo., on April 18.

UNIVERSITY OF UTAH

At its twenty-five meetings held during the 1941–1942 school year the Chapter had the privilege of hearing eighteen lectures by representatives of various professions, who spoke upon subjects of particular interest to the civil engineer. Slides and motion pictures added to the interest of some of the meetings. Two meetings were of special importance—one with the Chapter from the Utah State Agricultural College, and the other a joint dinner meeting with the Utah Section of the Society.

WASHINGTON STATE COLLEGE

Chapter meetings during the past year were devoted to student discussions of timely topics, talks by faculty members, and the presentation of a film on Grand Coulee Dam. On two occasions the Chapter was host to Local Section meetings.

UNIVERSITY OF WASHINGTON

The first class in twenty-four years to graduate under war conditions now leaves to take its place in both civilian and military phases of the war effort. Considering the circumstances, the officers and members of the Chapter feel that the activities of the year have been entirely satisfactory. Chapter activities included a joint banquet with the Seattle Section and a field trip to the Seattle sewage disposal plant. The speaker at the banquet was Milo T. Bell, who discussed "Civil Engineering Problems Connected with Fish Conservation." The Chapter entered teams in football, baseball, and bowling tournaments, sponsored by the Engineering Council.

PART OF UNIVERSITY OF WASHINGTON STUDENT CHAPTER

Name of Chapter	No. of Members	Aver. Attend. at Mtgs. (Members Only)	No. of Meetings	Total No. of Visitors During Year	No. of Papers or Lectures				No. Meetings Attended by		Membership by Classes¶						% of Eligibles Who Are Members	Members of Faculty		Faculty Adviser	Contact Member
					By Students	By Faculty	By Others	Am. Soc. C.E. Illus. Lectures	Fac. Adviser	Cont. Mem.	Freshmen	Sophomores	Juniors	Seniors	Grad. Stud.	Evening Stud.		In Soc.	Not in Soc.		
Akron, Univ. of																					
Alabama Poly. Inst.	35	16	14	126	6	5	5	1	14	1	1	1	14	18	1	0	37	3	2	T. M. Lowe	A. R. Harvey, Jr.
Alabama, Univ. of	31	14	11	67	5	1	4	2	9	7	0	11	9	11	0	0	57	4	1	D. A. du Plantier	E. E. Michaels
Arizona, Univ. of	30	17	10	23	13	3	6	0	5	4	0	2	15	13	0	0	75	7	0	F. C. Kelton	G. T. Grove
Arkansas, Univ. of	18	14	18	8	20	0	2	4	10	2	0	0	9	9	0	0	95	3	1	W. R. Spencer	N. B. Garver B. W. Dees§
Brooklyn, Poly. Inst. of	74	32	14	15	1	3	10	..	13	0	0	15	7	13	0	39	100	13	4	E. J. Squire	E. L. Macdonald R. W. Albrecht§
Brown Univ.	9	7	8	15	5	0	2	0	3	3	0	2	3	4	0	0	..	2	1	W. R. Benford	H. E. Miller
Bucknell Univ.	26	10	10	131	5	0	0	3	6	1	7	6	8	5	0	0	89	3	1	D. M. Griffith	J. T. Fetherston
California Inst. of Tech.	33	16	10	178	2	1	8	1	8	4	0	4	9	20	0	0	87	8	1	Franklin Thomas	H. M. Jones W. W. Moore§
California, Univ. of	204	74	7	100	0	2	5	0	7	3	11	37	58	95	3	0	62	12	1	C. T. Wiskocil	Walter Dryer H. G. Crowle§
Carnegie, Inst. of Tech.	48	42	28	168	15	0	18	1	28	1	0	21	12	15	0	0	100	6	1	F. M. McCullough	J. F. Laboon W. S. Beall§
Case School of Applied Sci.	54	32	9	60	7	3	2	2	7	2	..	18	22	14	0	0	100	7	0	G. E. Barnes	M. S. Brown
Catholic Univ. of Amer.																				F. A. Biberstein, Jr.*	R. W. Berry
Cincinnati, Univ. of	67	19	12	36	0	1	3	0	5	2	9	14	23	21	0	0	..	4	1	R. W. Renn	F. W. Morrill
Citadel, The	57	27	10	5	3	1	1	1	7	2	0	13	29	15	0	0	57	2	5	John Anderson	J. E. Gibson
Clarkson Col. of Tech.	21	20	5	6	0	1	3	0	4	1	1	3	9	8	0	0	81	4	1	W. J. Farrisee	W. T. Fields
Colorado State Col.	17	..	12	..	4	3	3	4	10	4	0	1	4	12	0	0	0	3	2	N. A. Christensen	L. K. Hill R. L. Parshall‖
Colorado, Univ. of	49	29	21	260	26	0	9	0	21	3	0	3	17	28	1	0	53	7	1	C. L. Eckel	R. N. Tracy L. W. Crandall§
Columbia Univ.	13	13	11	70	0	8	3	0	11	0	0	0	10	1	2	0	93	8	1	J. K. Finch	E. P. Goodrich S. A. Olin§
Connecticut, Univ. of	25	23	8	37	2	1	4	1	6	3	0	8	12	5	0	0	..	3	1	A. N. Vanderlip	H. W. Buck
Cooper Union	65	27	8	12	1	1	4	..	4	4	0	11	2	4	0	0	83	7	8	R. C. Brumfield	W. H. Yates W. C. Stevens§
Cornell Univ.	98	23	11	174	3	2	3	0	11	3	10	55	38	19	5	0	44	16	9	F. A. Barnes	H. E. Snyder
Dartmouth Col.	23	11	24	336	30	0	3	1	21	0	0	0	0	15	8	0	72	3	0	W. P. Kimball	
Dayton, Univ. of	12	12	15	174	10	2	6	0	14	2	0	4	4	4	0	0	100	3	2	C. J. Belz	C. H. Stephens R. H. Gates§
Delaware, Univ. of	28	14	4	38	0	0	3	0	3	1	9	11	5	3	0	0	100	2	1	T. D. Mylrea	C. E. Grubb
Detroit, Univ. of	23	23	6	12	0	0	7	0	6	1	6	4	6	7	0	0	77	4	0	C. C. Johnson	L. V. Garrity
Drexel Inst. of Tech.	43	31	5	19	0	1	1	0	3	0	6	8	18	11	0	0	48	5	1	S. J. Leonard	H. J. Stetina J. B. Letherbury§
Duke Univ.	24	16	11	15	12	2	2	3	11	1	0	9	7	8	0	0	100	3	1	J. D. Watson	H. W. Kueffner
Florida, Univ. of	33	18	12	53	4	1	2	2	9	1	0	10	15	8	0	0	92	3	0	H. J. Miles	J. F. Reynolds Manuel Gomez§
George Washington Univ.	28	11	11	157	0	2	5	0	10	0	9	9	5	5	0	0	40	3	5	C. H. Walther	J. D. Fitch P. A. Joray§
Georgia School of Tech.	100	20	11	14	0	1	3	1	11	5	0	31	42	27	0	0	0	2	2	R. P. Black	Paul Weir
Harvard Univ.	32	16	5	320	0	1	5	0	5	1	0	0	5	8	19	0	..	9	0	Albert Haertlein	A. B. Edwards Heber Wells§
Idaho, Univ. of	52	22	12	35	0	4	1	0	8	0	16	9	18	9	0	0	68	7	1	A. S. Janssen	W. P. Hughes
Illinois Inst. of Tech.	63	50	11	40	1	1	8	0	10	3	0	22	17	23	1	0	100	10	0	S. M. Spears	A. L. R. Sanders
Illinois, Univ. of	203	90	14	187	0	0	10	0	12	7	32	35	43	93	0	0	69	37	0	J. J. Doland	W. D. Gerber J. G. Clark§
Iowa State Col.	86	51	14	150	2	3	9	2	13	5	5	22	27	32	0	0	52	24	1	Frank Kerekes	M. B. Morris
Iowa, State Univ. of	22	21	24	25	25	2	6	4	24	2	0	0	9	13	0	0	..	12	0	E. L. Waterman	L. C. Crawford J. M. Robertson§
Johns Hopkins Univ.	27	22	9	104	0	3	3	0	8	0	0	7	8	11	0	1	56	8	1	T. F. Comber	W. T. Ballard R. C. Regnier§
Kansas State Col.	60	51	13	19	6	3	4	0	13	1	0	0	36	24	0	0	100	8	2	F. F. Frazier*	W. E. Baldry
Kansas, Univ. of	46	19	10	40	5	2	2	1	7	0	0	12	14	20	0	0	87	8	0	G. W. Bradshaw	C. K. Mathews
Kentucky, Univ. of	72	70	30	10	10	15	8	6	30	2	0	28	20	24	0	0	100	4	1	W. J. Carrel	J. S. Watkins
Lafayette Col.	18	..	11	..	6	2	0	5	10	1	0	6	4	8	0	0	64	5	..	E. H. Rockwell	L. V. Fisher
Lehigh Univ.	31	26	5	30	3	1	4	0	4	5	4	9	6	12	0	0	37	8	0	Hale Sutherland	L. V. Fisher
Louisiana State Univ.	27	18	12	11	3	0	3	0	3	2	0	7	12	8	0	0	97	6	1	F. F. Pillet	C. V. Baker
Louisville, Univ. of	22	11	18	65	2	0	4	1	6	1	5	5	6	6	0	0	79	2	1	W. R. McIntosh	J. V. B. Wells H. R. Gohmann§
Maine, Univ. of	29	23	7	21	4	1	5	0	7	1	0	2	14	13	0	0	43	1	5	W. S. Evans	H. L. Doten
Manhattan Col.	99	74	9	38	0	0	5	0	9	0	0	36	37	26	0	0	100	5	4	J. J. Costa	A. V. Sheridan J. J. Lanigan§
Marquette Univ.	25	15	7	44	0	0	1	1	5	2	0	6	11	8	0	0	63	1	2	O. N. Olson	Lloyd Knapp G. F. Nuernberger§
Maryland, Univ. of	36	22	8	5	3	2	3	3	4	1	0	0	23	13	0	0	82	3	4	S. S. Steinberg	H. H. Allen
Mass. Inst. of Tech.	50	22	12	1,625	3	1	2	1	9	0	0	10	19	21	0	0	69	21	3	J. D. Mitsch	S. M. Ellsworth
Mich. Col. of Min. & Tech.	30	20	8	1	2	0	1	0	4	0	9	2	10	9	0	0	57	4	3	W. C. Polkinghorne	L. F. Levin
Michigan State Col.																				C. L. Allen	H. L. Conrad
Michigan, Univ. of	41	24	9	29	0	4	1	0	7	5	0	12	15	14	0	0	..	18	0	W. J. Emmons	R. L. McNamee
Minnesota, Univ. of	111	34	8	15	0	1	2	0	3	2	0	27	30	53	1	0	76	5	1	Paul Andersen*	H. M. Hill P. L. Thomas§
Mississippi State Col.	38	36	8	5	0	2	3	3	8	1	0	11	11	16	0	0	75	3	1	J. C. Bridger	N. H. Rector P. A. Sherman§
Mississippi, Univ. of	40	24	12	11	2	3	5	2	12	1	18	9	9	4	0	0	57	2	0	L. H. Johnson, Jr.	F. V. Ragsdale
Mo. School of Mines & Met.	54	40	13	101	9	0	10	0	13	0	0	16	18	20	0	0	81	5	0	E. W. Carlton	C. P. Owens J. A. Short§
Missouri, Univ. of	31	31	7	5	0	0	4	0	6	0	0	5	14	12	0	0	48	7	2	Harry Rubey	S. M. Rudder
Montana State Col.	14	14	26	0	36	0	2	8	26	1	0	1	7	6	0	0	100	0	2	L. D. Conkling*	C. S. Heidel
Nebraska, Univ. of	25	19	8	11	0	0	6	1	8	4	0	6	12	7	0	0	53	4	0	H. J. Kesner	J. G. Mason J. V. Risser§
Nevada, Univ. of	19	13	9	73	0	0	6	0	9	5	0	5	7	6	1	0	63	2	0	F. L. Bixby	C. L. Hill H. F. Percival§
New Hampshire, Univ. of	19	15	15	30	13	2	4	0	14	1	0	0	13	6	0	0	40	4	0	E. W. Bowler	L. F. Johnson

NAME OF CHAPTER	NO. OF MEMBERS	AVER. ATTEND. AT MTGS. (MEMBERS ONLY)	NO. OF MEETINGS	TOTAL NO. OF VISITORS DURING YEAR	NO. OF PAPERS OR LECTURES				NO. MEETINGS ATTENDED BY		MEMBERSHIP BY CLASSES¶						% OF ELIGIBLES WHO ARE MEMBERS	MEMBERS OF FACULTY		FACULTY ADVISER	CONTACT MEMBER
					By Students	By Faculty	By Others	Am. Soc. C.E. Illus. Lectures	Fac. Adviser	Cont. Mem.	Freshmen	Sophomores	Juniors	Seniors	Grad. Stud.	Evening Stud.		In Soc.	Not in Soc.		
New Mexico State Col.	10	6	13	0	25	0	1	1	10	0	0	0	2	8	0	0	..	2	1	D. B. Jett	W. W. Baker
New Mexico, Univ. of																				Wm. Hume, II	H. W. Yeo
New York, Col. of the City of	65	29	25	13	6	0	9	3	3	2	0	0	11	54	0	0	..	16	4	C. W. Cunningham	D. B. Steinman
New York Univ.	88	25	22	35	0	6	7	1	13	6	0	33	11	22	0	0	85	8	1	Douglas Trowbridge	W. J. Armento§ A. G. Hayden
Newark Col. of Eng.	47	28	10	74	0	0	8	0	9	2	0	17	15	6	0	0	94	6	0	D. C. Frost	V. R. Cartelli§ Charles Gilman
North Carolina State Col.	48	32	16	40	2	5	2	0	12	2	0	15	16	17	0	0	68	7	1	C. L. Mann	R. H. Gilman§ T. S. Johnson
North Dakota Agri. Col.																				W. F. Babcock‡	R. H. Grady§
North Dakota, Univ. of	13	7	11	23	2	1	1	2	7	1	0	1	5	7	0	0	77	3	0	Alfred Boyd	J. P. Kennedy
Northeastern Univ.	104	37	12	35	5	0	6	1	9	3	0	22	59	23	0	0	77	4	1	C. O. Baird, Jr.	M. N. Clair
Northwestern Univ.	24	11	14	37	0	0	2	0	8	4	6	7	4	7	0	0	..	..	..	L. T. Wyly	Albert Smith
Norwich Univ.	46	22	11	6	0	0	1	2	9	1	18	7	14	7	0	0	58	..	0	A. D. Taylor*	H. J. Alwart§ T. W. Dix
Ohio Northern Univ.	31	31	20	8	15	1	4	3	19	0	6	14	4	7	0	0	100	1	0	A. R. Webb	F. L. Gorman
Ohio State Univ.	32	24	12	148	0	0	6	0	10	4	0	12	8	12	0	0	44	8	2	C. H. Wall	C. W. Allen
Oklahoma A.&M. Col.	36	19	14	10	0	4	7	0	14	0	5	5	12	14	0	0	37	10	1	L. D. Boswell	J. L. Monarchi§ V. H. Cochrane
Oklahoma, Univ. of	50	27	9	25	0	0	7	0	9	6	0	18	17	15	0	0	98	1	4	J. F. Brookes	Guy H. James W. E. Price
Oregon State Agri. Col.	79	48	7	34	0	1	5	0	7	1	†	19	23	37	0	0	66	6	4	G. W. Holcomb	H. B. McInerney§ C. B. McCullough
Pennsylvania State Col.	60	31	9	54	1	2	6	1	9	3	8	18	13	21	0	0	55	10	6	L. W. Whitehead	H. J. Crumlish
Pennsylvania, Univ. of	24	19	4	24	0	0	3	0	4	2	2	7	7	8	0	0	46	4	2	H. C. Berry	Julius Adler
Pittsburgh, Univ. of	59	58	22	0	3	5	10	1	22	0	19	10	17	13	0	0	100	3	4	L. C. Mc Candliss	N. B. Jacobs
Princeton Univ.																				Philip Kissam*	H. F. Harris
Purdue Univ.	95	49	7	120	0	5	4	0	6	2	0	15	36	44	0	0	68	15	5	C. A. Ellis	M. R. Keefe
Rensselaer Poly. Inst.																					
Rhode Island State Col.	24	17	21	1,470	7	1	6	7	16	1	0	7	6	11	0	0	100	3	0	F. W. Stubbs, Jr.*	J. L. Murray
Rice Inst.	9	9	12	32	4	0	0	3	6	0	0	0	5	4	0	0	56	2	0	L. B. Ryon	S. W. Oberg
Rose Poly. Inst.	25	22	5	200	3	0	2	1	5	1	0	12	7	6	0	0	96	3	0	R. E. Hutchins	Fred Kellam
Rutgers Univ.	19	12	10	25	4	0	2	1	3	1	4	5	5	5	0	0	56	4	2	F. C. Mirgain	Morris Goodkind
Santa Clara, Univ. of	24	12	11	16	5	2	3	1	11	0	11	4	5	4	0	0	77	3	0	E. C. Flynn	J. E. Crabiel§ M. H. Antonacci
S.C., Clemson A.&M. Col. of	58	31	10	30	8	1	3	1	6	3	0	23	17	18	0	0	78	5	1	D. D. Curtis	H. T. Poe
South Carolina, Univ. of	31	2	18	25	1	4	3	0	2	2	0	9	11	11	0	0	..	3	0	W. E. Rowe	T. K. Legaré
South Dakota State Col.	47	21	12	68	3	3	2	1	7	0	20	13	4	10	0	0	84	3	1	H. B. Blodgett	J. L. Sorbel
S.Dak. State Sch. of Mines																					
Southern Calif., Univ. of	31	28	10	0	1	3	5	3	10	1	2	1	20	8	0	0	67	5	0	R. M. Fox	W. W. Hurlbut
Southern Methodist Univ.	34	12	13	51	10	1	5	6	5	3	2	3	20	9	0	0	81	3	0	S. Thompson	L. R. Ferguson
Stanford Univ.	40	18	24	104	1	2	11	0	16	16	0	0	11	19	10	0	97	9	4	H. A. Williams	A. L. Trowbridge
Swarthmore Col.	21	7	10	65	7	0	1	0	10	1	5	7	8	1	0	0	100	2	0	S. T. Carpenter	Barclay White
Syracuse Univ.	33	24	8	23	3	1	0	2	8	0	0	15	7	10	1	0	97	5	0	J. O. Eichler	G. D. Holmes
Tennessee, Univ. of	52	20	13	45	0	2	4	0	10	2	10	14	19	9	0	0	60	8	1	A. T. Granger	C. E. Nichols
Texas, A.&M. Col. of	138	71	16	56	11	2	8	2	12	2	22	32	36	48	0	0	45	14	0	J. T. L. Mc New	J. L. Guy§ O. A. Seward
Texas, Tech. Col.	31	14	14	30	5	0	4	0	8	4	1	7	4	19	0	0	41	5	3	G. W. Parkhill	F. J. Benson§ H. N. Roberts
Texas, Univ. of	73	32	15	94	6	2	5	0	14	4	0	9	26	38	0	0	40	12	0	J. A. Focht	T. Twichell
Tufts Col.	33	21	7	22	2	1	1	0	7	0	0	12	9	12	0	0	87	5	1	F. H. Crabtree	J. S. Crandall
Tulane Univ.	28	20	23	200	2	2	6	0	3	1	0	9	11	8	0	0	100	4	1	Donald Derickson	J. A. Mc Niven
Union Col.	35	16	6	18	1	3	1	0	6	2	0	12	9	14	0	0	100	3	2	W. C. Taylor	J. C. Baehr§ H. V. Gulick
Utah State Agri. Col.	87	21	12	20	0	2	1	0	3	0	23	12	30	22	0	0	55	6	2	H. R. Kepner	C. W. Davies§ O. C. Lockhart
Utah, Univ. of	52	47	25	49	1	4	18	0	25	0	0	26	20	6	0	0	100	4	1	A. Diefendorf	R. R. Woolley
Vanderbilt Univ.	23	..	11	7	0	3	2	0	1	1	0	8	8	7	0	0	100	3	1	W. A. Coolidge	J. S. Duder§ L. R. Currey, Jr.
Vermont, Univ. of	10	8	4	103	1	3	0	0	4	1	0	3	4	3	0	0	63	2	2	L. B. Puffer	J. F. Sharp§ G. E. Rickard
Villanova Col.	16	16	6	0	0	0	0	0	6	0	0	7	4	5	0	0	84	2	0	J. A. Oakey	J. J. Sweeney
Virginia Mil. Inst.	234	223	14	0	22	0	0	0	14	0	0	101	71	62	0	0	100	2	4	R. A. Marr	E. M. Hastings
Virginia Poly. Inst.	60	50	21	10	6	4	5	1	10	2	0	17	26	16	1	0	53	5	4	R. B. H. Begg	F. P. Turner
Virginia, Univ. of	23	15	8	2	2	0	2	1	6	0	14	3	2	4	0	0	96	2	0	E. W. Saunders	A. J. Saville
Washington, State Col. of																					
Washington Univ.	15	11	9	112	3	2	1	0	7	2	0	3	3	9	0	0	100	4	1	E. O. Sweetser	J. E. Vollmar
Washington, Univ. of	64	25	11	37	1	1	6	0	6	4	0	7	19	38	0	0	75	11	2	F. H. Rhodes	G. F. Hopkins
West Virginia Univ.	15	13	27	12	51	0	2	2	27	2	0	0	7	8	0	0	100	4	1	W. H. Baker	H. O. Cole
Wisconsin, Univ. of	86	38	13	189	0	5	8	2	10	3	16	19	15	36	0	0	51	8	5	J. G. Woodburn	H. O. Lord
Worcester Poly. Inst.	30	25	6	19	5	0	2	0	6	3	0	14	8	8	0	0	94	5	0	C. F. Meyer	J. A. Tosi
Wyoming, Univ. of	42	24	9	26	0	2	3	5	9	2	0	6	8	28	0	0	59	5	0	A. J. Mc Gaw	P. A. Upp
Yale University	14	10	10	500	0	3	3	0	10	10	0	0	5	9	0	0	93	8	1	C. W. Dunham	H. L. Blakeslee Grant Robley§
Totals	5,178		1,372	9,705	544	187	468	119			352	1,261	1,631	1,790	54	40	7,516				

* Acting Faculty Adviser
† Ineligible
‡ Junior Faculty Adviser
§ Junior Contact Member
‖ Alternate Contact Member
¶ Figures in these columns are those furnished by the Chapters themselves, and in some cases do not check with the total Chapter membership (Col. 1) as listed in the Society's files.

ITEMS OF INTEREST

About Engineers and Engineering

CIVIL ENGINEERING for December

SUBJECT to the wartime uncertainties that now beset the preparation of papers for publication, a number of highly informative articles are planned for the December issue.

Investigation of the cause and control of soil loss has been the task of the Southern Piedmont Soil and Water Conservation Station at Watkinsville, Ga. In his paper, John R. Carreker reviews the progress that has been made in planning crops to check the disastrous erosion which has destroyed the agricultural value of many southern farms.

The extra, continuing education in practical field work which makes it possible for an inspector to become an engineer is to be discussed by Harry O. Locher in the December issue. Mr. Locher's extensive construction experience has given him innumerable opportunities to observe the value of seasoned judgment in making it possible for an engineer to cope with the emergencies that arise on nearly every job.

Full preparedness against wartime civilian dangers necessitates careful planning for the evacuation of civilians from critical areas. A general plan for this is described in the article by Ray F. Riegelmeier. Selection and marking of routes plays an important part in this planning.

Expanding capacity of a large Canadian steel company necessitated increased space for coal handling. An additional yard was provided, and to serve it, one of the traveling bridges had to be moved from the old yard. The task of transferring this large and heavy structure, described in the article by D. C. Tenant, presented an opportunity to demonstrate the engineer's ability in utilizing old equipment as well as in developing new.

With restricted use of steel, renewed interest has been shown in the use of plain concrete for bridge arches. One of the earliest types of bridge, such structures have raised questions of analysis which recent studies have answered. Charles S. Whitney reviews the subject of structural proportioning of arch ribs and cites a number of notable examples of this type of bridge in this country and abroad.

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. AM. SOC. C.E.

"TIME is the essence of our problem tonite," ventured Professor Neare, "just as it is in this war. Have you engineers of the Club observed that this is the first war astraddle the date line? That the pious battle cry 'God is on our side' has been replaced by the complacent 'Time is on our side'? That there is a new field in our profession, 'Time Engineering,' with a tremendous staff of 'Temporary Engineers'?

"We were to compute the time when the blasts scheduled for 7:00 a.m. next December 7 at Tokyo will be heard at Shangri La, Shangri Lo, and Shangri Lum, thru the three tunnels acting as speaking tubes with air conditioned at 20 C. Who knows?"

"I don't," volunteered Joe Kerr, "but I'll guess. Since sound will travel 1,000 miles thru such air in 78 minutes, the repercussion to the north will be heard at 8:18 a.m. Tokyo time and Shangri La time. It will reach Shangri Lo at 9:36 a.m. Tokyo time, but as this base lies to the northeast near the 174th meridian east, local standard time will be 12:36 p.m. At Shangri Lum on the 165th meridian west, the boom will resound at 10:54 a.m. Tokyo time, which is 2:54 p.m. the day before by local time."

"Your clue that 'time is of the essence' invites amendments," commented Cal Klater. "In stating the problem, you spotted Shangri Lo indefinitely in the Aleutians and Shangri Lum in the Hawaiian Islands. So the former, enveloped by the offset Date Line, would record the noise at 2:36 p.m. December 6, Nome War Time; and the latter, in a special zone, would score the goal at 4:24 p.m. December 6, Hawaiian War Time."

"Good for you, Cal," applauded the Professor, "That was one of two approved solutions—the one for Civils. I hope some Mechanical Engineer will present the other."

"Perhaps the sound will travel faster in the rock walls of the tunnel."

"Perhaps, but 'speaking tube' action was specified."

"Or the air in the tunnel was liquefied by the pressure—but who knows the speed of sound in liquid air?"

"Good hunch," conceded Professor Neare. "Air cannot be liquefied at 20 C, but its molecules will be rubbing elbows. At midpoint of the 3,000-mile tunnel, 295 miles below the surface, the pressure will be 38,000 atmospheres. The air, still a gas but nearly as heavy as water, will transmit compression waves at 1.5 miles per sec. Integrating times for the three tunnels gives a surprising result. Elapsed times for the 1,000, 2,000 and 3,000-ft tunnels were 77, 70, and 64 minutes, respectively.

"Now for a real surprise, our first Guest Professoress—Ann Othernut. She dubs herself a Unique Engineer (from *una equus*, meaning 'one-horse')."

"Don't you worry, Old Man Noah. Mine is a romantic theme, about the Waltzing Matilda and the Far Hop Bridge in China. Now Matilda is an 18-ton tank with its balance 5 ft from the front of its 15-ft track, along which the load varies uniformly. The Far Hop Bridge is simply a granite girder, 6 ft square by 36 ft in span, weighing 150 lb per cu ft. General Tu Lung Yet ordered his engineer, No Foo Ling, to compute the maximum possible intensities of tension and shear with Matilda on the bridge—standing, not waltzing.

"Now General Tu wanted a smart son-in-law, so he offered a prize for the right answer, the choice of his daughters. He added, 'or else.'

"But Foo Ling, as a Boxer Scholar at M.I.T., had learned one lesson well, to marry the boss's daughter. So he eloped with the oldest.

"Matilda is still stalled and the impatient General offers both remaining daughters for a quick right answer."

"Splendid, Professor Ann. Count me in on the contest."

[*Guest Professoress Ann Othernut is masquerader J. Charles Rathbun. **Cal Klaters who knew their time were Richard Jenney, Matt Mattix** (David E. Hughes), and O'Kay (Otto H. S. Koch).*

Acknowledged belatedly are excellent solutions of the Corregidor Monument problem from James A. Nelson, Albyn Mackintosh, and Cal K. Lott (Joseph S. Lambie).]

Army Sanitary Corps Offers Commissions

ENGINEERS between the ages of 30 and 45 are needed for service with the Sanitary Corps of the Army. Experienced men only can be accepted for commissions as First Lieutenants and Captains. Although no military experience is necessary, a minimum of four years of actual experience in sanitary or public health engineering, in addition to graduation from an approved college or university, is required. The receipt of a master's degree in sanitary engineering may be substituted for 1$^1/_2$ years of civilian experience qualifications.

Inquiries and applications should be addressed to the War Department, Services of Supply, Office of the Surgeon General, Washington, D.C.

James F. Lincoln Arc Welding Foundation Awards

FOR 2$^1/_2$ years the James F. Lincoln Arc Welding Foundation has been carrying on its second industrial study on arc welding. The announcement on October 6, 1942, of awards totaling $200,000, was of special interest to civil engineers in that the first grand award of $13,700 and many other prizes, were in recognition of papers presented by members of the American Society of Civil Engineers.

Largest single prize went to A. Amirikian, M. Am. Soc. C.E., Designing Engineer, Bureau of Yards and Docks, Navy Department, and Captain C. A. Trexel (CEC) U.S.N., M. Am. Soc. C.E., Director of Planning and Design, Navy Depart-

A. Amirikian, M. Am. Soc. C.E.

Capt. C. A. Trexel (CEC), U.S.N., M. Am. Soc. C.E.

WINNERS OF LARGEST SINGLE PRIZE IN ARC WELDING CONTEST

ment. Their paper described the redesign of two caissons for naval dry docks to use welded construction. The method of elastic slab calculation was discussed.

An award of $3,200 was made to J. O. Jackson, M. Am. Soc. C.E., Chief Engineer of the Pittsburgh-Des Moines Steel Company, for his paper on the design of containers. Other prizes went to H. Malcolm Priest, M. Am. Soc. C.E., Engineer, Railroad Research Bureau, U.S. Steel Corporation Subsidiaries, Pittsburgh, Pa.; Glenn L. Enke, Assoc. M. Am. Soc. C.E., Assistant Engineer, Utah Pomeroy Morrison, Provo, Utah; Regis F. Frey, Jun. Am. Soc. C.E., Structural Engineer, Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.

The following members of the Society also received awards in the competition: C. Perry Streithof, Gonzalo C. Munoz, John F. Willis, Van Rensselaer P. Saxe, C. Merrill Barber, A. E. Niederhoff, Percival A. Fanner, R. W. D. Vore, B. M. Shimkin, Harold Nagin, Guy H. Elbin, Fred L. Plummer, and Robert C. Kennedy.

From Society to Army Employment

For a number of years Frank Reul was a valued member of the Headquarters staff in the clerical and mailing department. Then came the time in the spring of 1942 when he had to be loaned to Uncle Sam. As this letter to the staff shows, he seems to be as popular with his new employer as with the old.

WELL, folks, I hope you are all in as good health as when I left, or better. I have finished my training period as an infantry soldier and am now in the Engineers. I can't figure it out, but I guess that having worked for engineers I must look or act a little like one—that's the only reason I can see.

But I can assure you that the work we engineers do is quite a bit different from what takes place in the Society office. It's plenty warm here and the ground is mostly all sand, which doesn't help marching at all. The first day in camp we were issued complete equipment and went on a 22-mile hike. I guess that pushing my way through the crowds on 39th Street on a summer afternoon kept me in pretty good shape. Anyway, I can stand up as long as any of them.

Seeing that this is August, the mailing department doesn't have to run PROCEEDINGS this month; so they must have it pretty easy! I hope the men are all signing their mail early so the boys can get home on time. Better keep in good shape, Joe; we have a suit that fits you, too. This camp has everything from a reception center to artillery, infantry, paratroopers, and everything else you can think of. As it is an engineers' outfit, I was looking to see if we had any member of the Society here. Perhaps I could sell him some back copies of CIVIL ENGINEERING, or at least collect his dues. But I have had no luck so far.

This outfit does quite a bit of pontoon bridge building, which will be something entirely new to me. In this company where I am now, each man has had at least a year's training, so we have plenty to learn. The food here is good so I think I will stay a while, unless something turns up I don't like.

At my last camp we spent about a week and a half on the range and I qualified with the Springfield '03 and the light machine gun—so, Joe, you'd better get hold of the blow gun and do a little practicing. I'm sorry I can't write oftener, but this Army certainly makes sure you don't have too much time on your hands with nothing to do. I miss all of you and hope to see you soon.

Your friend,

FRANK REUL

P.S. This is a pretty *dry* state!

Brief Notes

THE Society of Naval Architects and Marine Engineers has announced its Fiftieth Annual Meeting, to be held in New York on November 12 and 13 at the Waldorf-Astoria Hotel. Papers on a variety of pertinent subjects will be presented at the sessions, morning and afternoon on Thursday and Friday.

A BOOKLET, "Postwar Planning for the Construction Industry," has recently been issued by the Producers' Council, Inc., a national organization of manufacturers of building materials and equipment—and their trade or product associations. According to its subtitle, the booklet is "a statement of the need, objectives, and procedures of a program to prepare the construction industry to do its part in maintaining full employment in the postwar period." Single copies may be obtained by anyone connected with the building industry on request to The Producers' Council, Inc., 815—15th Street, N.W., Washington, D.C.

Manhattan College Celebrates Fifty Years of Its School of Engineering

COMPLETION of a half century in the field of engineering education was commemorated on October 14, 1942, at Manhattan College. Exercises were held in the afternoon on the campus at Riverdale. Officiating at the ceremonies were the Most Reverend Francis J. Spellman, Archbishop of New York, as presiding officer, and Brother A. Victor, president of the college. The main address, "The Industrial Aspect of Technology," was delivered by Roy C. Muir, vice-president of the General Electric Company, who received an honorary doctorate.

Two members of the Society also received honorary degrees of doctor of engineering. They were Lt. Comdr. Emil H. Praeger, U.S.N.R., head of the civil engineering department at Rensselaer Polytechnic Institute, and Frederick H. Zurmuhlen, chief engineer, Walsh-Driscoll Corporation, New York, N.Y. Mr. Zurmuhlen is a graduate of Manhattan College, class of 1918.

These honorary degrees raise the total of those bestowed on members of the Society during the current year to 12. Previous honors of a similar character have been noted in the July, August, and September issues of CIVIL ENGINEERING.

NEWS OF ENGINEERS

Personal Items About Society Members

ABEL WOLMAN, professor of sanitary engineering at Johns Hopkins University, is a member of a delegation sent to Brazil by the U.S. Department of State to discuss public health problems in relation to the war and post-war developments.

U. S. GRANT III, brigadier general, Corps of Engineers, U.S. Army, has been appointed chairman of the National Capital Park and Planning Commission. General Grant's most recent assignment has been that of War Department representative on the Office of Civilian Defense Board for Civilian Protection.

ARTHUR W. BUSHELL, former director of engineering and construction for the

Connecticut State Highway Department, has been named deputy state highway commissioner.

Jacob M. Boyd, since 1926 county engineer for Palm Beach County, Florida, is now a lieutenant commander in the Civil Engineer Corps of the Navy.

Denzil Doggett has been commissioned a captain in the U.S. Corps of Engineers. Until lately Captain Doggett was state engineer for the Indiana State Department of Conservation.

Edward L. Pine, previously assistant office engineer for the U.S. Army Engineers at Seattle, Wash., was recently ordered to active service as a first lieutenant in the Corps of Engineers.

Carl B. Wirsching is now a major in the Corps of Engineers and has reported for duty at Camp Claiborne, La. Major Wirsching was formerly commissioner of the Board of Public Works for the City of Los Angeles (Calif.).

Walter Brooks has been promoted from the position of division engineer for the Tennessee State Highway Department at Knoxville to that of chief engineer of the Department.

Harvey Eustrom, major, Corps of Engineers, U.S. Army, was recently appointed area engineer at the Black Hills ordnance depot in South Dakota. Previously Major Eustrom served in a similar capacity at the Iowa ordnance plant.

Laurence J. Waller has announced that he will resume his consulting practice in Los Angeles, Calif. During the past year Mr. Waller has been employed as chief structural engineer on the construction of the War Department's office building at Arlington, Va.

Kenneth L. Roberts has been promoted from the position of associate conservationist for the U.S. Forest Service to that of hydrologic engineer. His headquarters will be Washington, D.C.

Harold B. Gotaas, formerly professor of sanitary engineering in the School of Public Health at the University of North Carolina, has been commissioned a captain in the Sanitary Corps and is serving as chief of the engineering section of the Division of Health and Sanitation in the Office of the Coordinator of Inter-American Affairs, Washington, D.C.

C. E. S. Bardsley, until recently specialist in engineering education in the U.S. Office of Education, Washington, D.C., is now with the Pittsburgh (Pa.) District of the Corps of Engineers, U.S. Army, with duties in the Hydrology and Flood Control Section.

Arnold H. Vanderhoof, lieutenant, U.S. Navy (retired), was returned to active duty in January 1942, and since then has been officer in charge of the Navy Hydrographic Office at the Custom House, Savannah, Ga. His office in Asheville, N.C., where he maintained a consulting practice, is to be closed in the near future.

E. W. Lane, formerly professor of hydraulic engineering at the University of Iowa, has joined the staff of the Water Control Planning Department of the Tennessee Valley Authority. His headquarters are Knoxville, Tenn.

Leonard C. Bailey, office engineer for the city of Knoxville, has been appointed acting city engineer.

R. L. Templin, until lately chief engineer of tests for the Aluminum Company of America, has been made an assistant director of the Aluminum Research Laboratories of the organization.

James E. Moreland is now a captain with the 360th Engineers at Camp Claiborne, La. Captain Moreland was previously principal highway engineer for the Tennessee Valley Authority at Knoxville, Tenn.

Charles D. Thomas has retired from the position of civil engineer with the New York City Board of Transportation. He is a lieutenant colonel in the Reserve Corps of the U.S. Army, but as yet has not been ordered to active service.

William G. Grove, formerly chief engineer for Zone VII of the War Department at Omaha, Nebr., has been transferred to the Sunflower Ordnance Works at Eudora, Kans., where he will serve in a similar capacity.

William J. Bobisch, Lt. (jg) CEC—V (S) U.S. Naval Reserve, recently reported for active duty to the 15th Naval District, Balboa, Canal Zone. Lieutenant Bobisch was formerly civil engineer for the Special Engineering Division of the Panama Canal.

Chen-Hsu T'ang is now an engineer for the Universal Trading Corporation, an official Chinese government agency for the procurement of equipment and materials under the Lend-Lease Act. His headquarters are in New York City. Until lately he was hydraulic engineer for the Ebasco Services, Inc., in New York.

Philip T. Samuel, lieutenant colonel, Corps of Engineers, U.S. Army, is now executive officer for the Philadelphia (Pa.) Engineer District. Prior to his recent appointment to active duty, Colonel Samuel was head engineer for the Philadelphia District in charge of the Marine Division.

W. C. Youngs, Jr., for some years senior testing and research engineer for the Texas State Highway Department, has accepted a commission as captain in the Corps of Engineers and is stationed at Dallas, Tex.

T. L. Bransford has been commissioned a lieutenant in the Corps of Engineers, U.S. Army, stationed at Tullahoma, Tenn. Before his appointment Lieutenant Bransford was with the Tennessee State Highway Department at Chattanooga.

Datus E. Proper, executive vice-president of the Texas Good Roads Association, San Antonio, Tex., was elected a director of Rotary International at the Annual Rotary Convention in Toronto, Canada. He is one of six directors from North America named to the Board.

DECEASED

Chester Robert Chadwick (Assoc. M. '11) industrial engineer for the Stone and Webster Engineering Corporation, died on September 24, 1942. Early in his career Mr. Chadwick was with the American Bridge Company and, later, was assistant to the manager of the Dominion Bridge Company at Montreal, Canada. For a number of years he was structural engineer for Stone and Webster.

Clare Harmon Currie (M. '18) president and manager of the Currie Engineering Company at Webster City, Iowa, died on September 17, 1942. He was 60. From 1908 to 1915 Mr. Currie was engaged in drainage work in northern Iowa. From 1912 on, as head of the Currie Engineering Company, he maintained a sanitary engineering practice in Iowa and California. He was a former president of the Iowa Section.

George Stewart Davison (M. '90; Hon. M. '37) president of the Pennsylvania Water Company, Pittsburgh, Pa., died on October 3, 1942. Mr. Davison, who was 86, had served as Director, Vice-President, and President of the Society. A more detailed biography and photograph appear in the "Society Affairs" section of this issue.

John Adams Guissinger (Assoc. M. '15) of Magnolia, Ark., died at his home there on August 30, 1942, at the age of 57. For the past nine years Mr. Guissinger had been an engineer for the Arkansas State Highway Department, leaving that organization recently for work at an ordnance project near Sidney, Nebr. Earlier in his career he was with the John L. Humbard Construction Company at Knoxville, Tenn.

Ernest Frederick Hartman (Affiliate '10) president of the Protexol Corporation, Kenilworth, N.J., died late in September. Mr. Hartman, who was 63, was a specialist in the field of wood preservation and had been engaged in that work since 1901. The author of several volumes on the subject, he acted as consultant in the preparation of treating specifications for the Hell Gate Bridge and the Mississippi River Bridge at New Orleans.

Otto Julius Marstrand (M. '90) died at his home at Rowledge, Surrey, England, on February 24, 1942, though word of his death has just reached the Society. He was 82. Born in the West Indies, Mr. Marstrand was educated in Denmark and the United States. Early in his career he was engaged on the construction of sections of the New York Elevated Railroad and, for a time, was a lecturer at Lehigh University. From 1900 on he was a civil and refrigerating engineer in London. During this period he represented the Atlas Company, of Copenhagen, and was engaged in the installation of a number of large refrigerating plants in the British Isles and Straits Settlements.

William Griffith Moler (Assoc. M. '00) of Charlottesville, Va., died in Springfield, Ohio, on September 13, 1942, at the age of 83. For many years Mr. Moler was a member of the New York consulting firm of Marroquin and Moler. He had been special representative of the Mexican government and was, also, in charge of developing La Sautena, a large irrigation project in northern Mexico. Until recently he was American representative and purchasing engineer for Cia Fundidora de Fierro y Acero de Monterrey, Mexico.

James Lafayette Parker (M. '21) senior highway bridge engineer for the Public Roads Administration, Washington, D.C., died on August 10, 1942. He was 61. For some time Mr. Parker was connected with Herbert C. Keith, New York City consultant, and later was with the South Carolina State Highway Department. More recently he was in private practice in Charleston, S.C. He became connected with the Public Roads Administration about four years ago.

Milton Gerry Starrett (M. '00) retired consulting engineer of New Canaan, Conn., died on September 18, 1942, at the age of 81. Early in his career Mr. Starrett was engaged in railroad and subway work in Boston, Brooklyn, and New York—from 1896 to 1906 as assistant chief engineer and chief engineer of the Metropolitan Street Railway and its successor companies. From the latter year on he was in private practice, specializing in electric railways, power, and lighting work.

Arthur Clarence Tozzer (M. '21) vice-president and director of the Turner Construction Company, New York, N.Y., died at his home in Scarsdale, N.Y., on September 9, 1942. Mr. Tozzer, who was 63, became connected with the Turner Company in 1905 as a superintendent, and later was made general superintendent in charge of New England operations. In 1919 he was elected a vice-president and head of the Boston office, and he was executive vice-president in the New York office from 1928 to 1937. The U.S. Army Supply Base at Brooklyn, N.Y., was built under his supervision during the first World War.

Frank Edgar Walter (Assoc. M. '14) chief engineer for the Inter-County River Improvement District for King and Pierce counties (Washington) was killed by electric shock at his summer home on Puget Sound on August 29, 1942. Mr. Walter had served as district manager for the WPA at Tacoma, and had been road supervisor for Pierce County. Earlier in his career he was resident engineer for the Ohio State Highway Department at Akron, Ohio.

Alvin Drummond Wilder (M. '25) since 1938 director of the Department of Public Works, City and County of San Francisco (Calif.), died on September 18, 1942. He was 57. From 1911 to 1915 Mr. Wilder was in the engineering department of the Pan-Pacific International Exposition. Later he spent some years with the Canadian Pacific Railway, his projects for that line including bridge building and the placing of a concrete lining in the Connaught Tunnel. From 1923 to 1926 he was engaged in the construction of a deep sea pier and passenger terminal at Vancouver, B.C.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From September 10 to October 9, 1942, Inclusive

ADDITIONS TO MEMBERSHIP

Allen, James Frederick (Assoc. M. '42), Maj., U.S. Army, Headquarters and Headquarters, F.A.R.C., Fort Bragg, N.C.

Anderson, George Bayles (Jun. '42), 2d Lt., U.S. Army, 114 Robbins St., Port Jefferson, N.Y.

Anderson, Royal Paine (Jun. '42), With Eng. Staff, Curtiss-Wright Corp., Plant 2, Genesee St. (Res., 6472 Transit Rd.), Depew, N.Y.

Andrews, Malcolm George (Jun. '42), Ensign, U.S.N.R., 169 Ash St., Willimantic, Conn.

Arena, Joseph Richard (Assoc. M. '42), Associate Structural Engr., Structural Section, U.S. Engrs., Box 4970, Jacksonville, Fla.

Barber, Bert Dillon (Jun. '42), Structural Draftsman, Am. Bridge Co. (Res., 444 Park Rd.), Ambridge, Pa.

Barr, Robert Thomson (Jun. '42), Res. Officer in Chg., Constr., U.S.N., Care, Farrel-Birmingham, Buffalo (Res., 42 Woodland Ave., Bronxville), N.Y.

Bashore, Harry William, Jr. (Jun. '42), Asst. Eng. Aide, U.S. Public Roads Administration, Whitehorse, Yukon Territory, Canada. (Res., 3930 Huntington, N.W., Washington, D.C.)

Battershill, Charles Arthur (M. '42), Cons. Engr., 466 Hawthorn, Glen Ellyn, Ill.

Beckett, Humphrey (M. '42), Supt., Water Dept., Dist. of Columbia, Washington, D.C.

Beer, Stanley William (Jun. '42), Constr. Supt., Arnold M. Diamond, 50 Court St. Brooklyn (Res., 107–30 One hundred and twenty-fifth St., Richmond Hill), N.Y.

Belcher, Clarence Edward (Jun. '42), 1st Lt., U.S. Army, 350th Engr. Regiment, Camp Shelby, Miss.

Bergquist, Gustav Harry (Jun. '42), Stress Analyst, Goodyear Aircraft Corp. (Res., 40 North Portage Path), Akron, Ohio.

Bolon, Leslie Wilson (Jun. '42), Ensign, U.S.N.R., 869 Virginia Ave., N.E., Atlanta, Ga.

Bowsher, Harold Eugene (Jun. '42), 2d Lt., U.S. Army, 48th Engr. Regiment (C), Company F, Camp Gruber, Okla.

Brennan, John Joseph (Jun. '42), Junior Naval Archt. P-1, Navy Yard (Res., 1205 Foulkrod St.), Philadelphia, Pa.

Brooks, Charles Carroll (Jun. '42), Ensign, U.S.N.R., 4911 Roland Ave., Baltimore, Md.

Brown, David Charles (Jun. '42), Draftsman, Am. Bridge Co., Park Rd. (Res., 298 Glenwood Rd.), Ambridge, Pa.

Brown, James Rae (Jun. '42), 1st Lt., Corps of Engrs., U.S. Army, 2755 College Ave., Terre Haute, Ind.

Buntyn, James Russell (Assoc. M. '42), Capt., Coast Artillery Corps, U.S. Army, Reserve Officer's Training Corps, State College, Miss.

Campbell, George Prentiss (Jun. '42), With P.R.R., Room 129 Pennsylvania Station, New York (Res., 108 Pierrepont St., Brooklyn), N.Y.

Carroll, George Edward (Jun. '42), Engr., Pan-Am. Highway System, 729 South Figueroa St., Los Angeles, Calif.

Cavanaugh, Thomas George, Jr. (Jun. '42), Junior Constr. Engr., Turner Constr. Co., 420 Lexington Ave., New York, N.Y. (Res., 60 Maplewood Ave., West Hartford, Conn.)

Chalfant, Ray King, Jr. (Jun. '42), 2d Lt., Corps of Engrs., U.S. Army, Army Post Office 701, Care, Postmaster, Seattle, Wash.

Cohen, Arthur Aaron (Jun. '42), Senior Eng. Aide, Survey and Drafting Div., U.S. Engrs. (Res., 5526 Romaine St.), Los Angeles, Calif.

TOTAL MEMBERSHIP AS OF OCTOBER 9, 1942

Members	5,845
Associate Members	7,020
Corporate Members	12,865
Honorary Members	34
Juniors	4,980
Affiliates	71
Fellows	1
Total, Oct. 9, 1942	17,951
(Total, Oct. 9, 1941	17,012)

Cosgrove, John Daniel, 2d (Assoc. M. '42), Associate Engr., U.S. Engr. Office, Easton, Md.

Crandall, Paul Stuart (Jun. '42), Lt., Corps of Engrs., U.S. Army, 100 Hancock St., Lexington, Mass.

Creel, Henry Grady, Jr. (Jun. '42), 2d Lt., Corps of Engrs., U.S. Army, 25th Armored Engr. Battalion, Army Post Office 256, Camp Chaffee, Ark.

Crumbliss, Roy Charles (Jun. '42), 2d Lt., Corps of Engrs., U.S. Army, Company F, 97th Engr. Regiment, Army Post Office 989, Care, Postmaster, Seattle, Wash.

Daley, Austin Christopher (Jun. '42), Ensign, U.S.N.R., Aviation Specialist, Main Office, Assembly and Repair Dept., U.S. Naval Air Station (Res., 6814 Powhatan Ave.), Norfolk, Va.

Darling, William Amstutz (Jun. '42), Stress Engr., Boeing Aircraft Co., Seattle, Wash. (Res., 2615 West Drive, Fort Wayne, Ind.)

Dell, Harold Kleiber, Jr. (Jun. '42), Shipfitter, Bethlehem-Fairfield Shipyard, Inc., Fairfield (Res., 523 West 40th St., Baltimore), Md.

Del Vecchio, Philip (Jun. '42), Aviation Cadet, Air Force, U.S. Army, 327 North 13th St., Newark, N.J.

Dember, Seymour (Jun. '42), Junior Civ. Engr., TVA, Chattanooga, Tenn.

Diegel, Archie William, Jr. (Jun. '42), Junior Civ. Engr., TVA, Fort Loudoun Dam (Res., 308 East 3d Ave.), Lenoir City, Tenn.

Dienhart, Arthur Vincent (Jun. '42), Junior Engr., Dravo Corp., Neville Island (25), Pittsburgh, Pa. (Res., 5128 Queen Ave., South, Minneapolis, Minn.)

Douglas, Donald (Assoc. M. '42), Chf. Engr., Murray Erick, 811 West 7th St. (Res., 455 South Berendo St.), Los Angeles, Calif.

Douglas, Walter Edwin, Jr. (Jun. '42), Junior Engr., U.S. Engrs., Ft. of Prytania St. (Res., 5534 South Liberty St.), New Orleans, La.

Douglass, James Carl (Assoc. M. '42), Associate Engr., U.S. Bureau of Reclamation (Res., 207 West Myrtle St.), Fort Collins, Colo.

Downes, Harold John (Jun. '42), Draftsman, Curtiss-Wright Corp. (Res., 751 College Ave.), Columbus, Ohio.

Durey, John Hamilton (Jun. '42), Transitman Turner Constr. Co. & Louis Mayershon, 800 Floyd Ave., Rome (Res., Canada Lake), N.Y.

Dwyer, Charles Francis (Jun. '42), Structural Steel Draftsman, Giffels & Vallet, Inc., 1000 Marquette Bldg., Detroit, Mich. (Res., 1295 Eaton St., Denver, Colo.)

Ellis, Elon Ellsworth (Jun. '42), Structural Test Engr., Boeing Aircraft Co. (Res., 5241 Eighteenth Ave., N.E.), Seattle, Wash.

Ellis, Ralph Henry (Jun. '42), Junior Civ. Engr., TVA, 201 Pound Bldg., Chattanooga, Tenn.

Erickson, Hugo Gustaf (M. '42), 1st Lt., Air Corps, U.S. Army, Headquarters Squadron, W.C.A.A.F.T.C., Santa Ana, Calif.

Erickson, Neil Rodney (Jun. '42), Chainman, Willmar Div., G.N. Ry., Willmar, Minn.

Estes, Morgan Reid (Assoc. M. '42), Asst. Project Mgr., Leibert-Trobock, Caletti & Leibert, Cheda Bldg., San Rafael, Calif.

Ewin, James Perkins, Jr. (Jun. '42), 2520 Prytania St., New Orleans, La.

Fant, Jesse Ernest (Jun. '42), With Pennsylvania R.R., Office, Supervisor of Track, Union Station (Res., 65 East 13th Ave.), Columbus, Ohio.

Ferretti, Henry Louis (Jun. '42), Ensign, CEC, U.S.N.R., Norfolk Navy Yard, Portsmouth, Va. (Res., Nanuet, N.Y.)

Fogarty, Edward John, Jr. (Jun. '42), 901 East 41st St., Savannah, Ga.

Frerich, William Robert (Jun. '42), Ensign U.S.N.R., Field House, Dartmouth College Hanover, N.H.

Frink, John Westlake (Jun. '42), Junior Geologist, TVA, Hales Bar Dam, Guild, Tenn.

Gardner, John Miles (M. '42), Chf. Estimator, The Austin Co., 19 Rector St., New York, N.Y.

Garrett, John A. (Assoc. M. '42), Area Supt., WPA (Res., 602 Canal St.), Decatur, Ala.

Gartland, Edward Vincent, Jr. (Jun. '42), 2d Lt., Corps of Engrs., U.S. Army, 111 Colby Rd., North Quincy, Mass.

Gittings, Elisabeth Fisher (Jun. '42), With Naval Ordnance Laboratory, Navy Yard (Res., 4644 Hillside Rd., S.E.), Washington, D.C.

Gordon, George (Jun. '42), 705 Chandler Ave. Linden, N.J.

Grehan, Bernard Albert (Jun. '42), Ensign, U.S.N.R., 1670 Soniat St., New Orleans, La.

Greitzer, Milton Schwartz (Jun. '42), Aviation Cadet, Air Corps, U.S. Army, 656 South 15th St., Newark, N.J.

Grimm, James Walter (M. '42), Senior Asst. Subway Engr., Dept. of Subways and Superhighways, City of Chicago, 20 North Wacker Drive (Res., 6149 North Claremont Ave.), Chicago, Ill.

Grow, Virgil Byron, Jr. (Assoc. M. '42), Field Engr., Portland Cement Assn., State Planters Bank Bldg., Richmond, Va.

Guldermann, Eugene Josslyn (Jun. '42), With Corps of Engrs., U.S. Army, Steele, N.Dak.

Hall, Charles Loring, Jr. (Jun. '42), Res. Officer, In Chg., Constr., Remington Rand; Care, Laurance C. Roberts, Elmira, N.Y. (Res., 17410 Fairway Drive, Detroit, Mich.)

Hall, Robert Lyman (Jun. '42), Draftsman, Stone & Webster Eng. Corp., Taylor St. (Res., 4108 Indiana Ave.), Fort Wayne, Ind.

McEntyre, John Gerald (Jun. '42), 2d Lt., Coast Artillery (Antiaircraft) Reserve, U.S. Army, Battery B, 203d Coast Artillery (Antiaircraft), Army Post Office 944, Care, Postmaster, Seattle, Wash.

Hancock, John David (Jun. '42), Junior Engr., U.S. Engr. Dept., Box 59 (Res., 649 South Floyd St.), Louisville, Ky.

Hansen, Philip Charles (Jun. '42), Junior Civ. Engr., TVA, Gilbertsville, Ky.

Hartman, Herbert Joyce (Jun. '42), Lt., CEC, U.S.N., SSA, Care, Postmaster, San Francisco, Calif. (Res., 15$^1/_2$ South High St., Athens Ohio.)

Hartwell, David Lawrence (Jun. '42), Junior Engr., Public Works Dept., 15th Naval Dist., U.S.N., 101 Dist. Headquarters Bldg., Balboa, Canal Zone.

Hedgpeth, Lewis Sterling (Assoc. M. '42), Engr. (Civ.), U.S. Engr. Office, 169 East Flagler St., Miami, Fla.

Heilmann, John Sherman (Assoc. M. '42), Engr., MacDonald & Kahn, Inc., Financial Center Bldg. (Res., 1943 Cabrillo St.), San Francisco, Calif.

Hilp, Harry Henry (M. '42), (Barrett & Hilp), 918 Harrison St., San Francisco, Calif.

Horton, Ernest Lafayette, Jr. (Jun. '42), 2d Lt., Corps of Engrs., U.S. Army, 758 Jeanette St., Abilene, Tex.

Huston, James Francis, Jr. (Jun. '42), Stress Analyst, Fleetwings, Inc., Bristol (Res., 4216 Tyson St., Philadelphia), Pa.

Hyland, Ronald Tait (M. '42), Gen. Supt., Kershaw, Swinerton & Walberg, Rocky Mountain Arsenal (Res., 3916 Stuart St.), Denver, Colo.

Jacobi, Thomas Richard (Assoc. M. '42), Lt., CEC-V(S), U.S.N.R., Officer in Chg. of Design, U.S. Naval Ammunition Depot (Res., 837$^1/_2$ Burlington), Hastings, Nebr.

Jensen, Ivan Raymond (Jun. '42), Junior Engr., E. I. du Pont de Nemours & Co. (Res., 1815 South 7th St.), Minneapolis, Minn.

Johnson, Arthur, Jr. (Jun. '42), Junior Hydr. Engr., TVA, 700 Union St. (Res., 1716 West Clinch Ave.), Knoxville, Tenn.

Johnson, John McGill (Jun. '42), Constr. Engr. Prouty Brothers Eng. Co., Box 111, Fremont, Nebr. (Res., 1047 East Lester St., Tucson, Ariz.)

Jowers, Afton Bradford (Jun. '42), Junior Structural Engr., TVA, 200 Arnstein Bldg. (Res., 1812 White Ave.), Knoxville, Tenn.

Katz, Allen Marvin (Jun. '42), Lt., Company A, 115th Engr., U.S. Army, 204 East Opdyke St., Chester, Ill.

Kealy, Philip Joseph (M. '42), Chairman, Board of Superv. Engrs., Chicago Traction, 231 South La Salle St., Chicago, Ill.

Kellogg, Frederic Hartwell (M. '42), Senior Materials Engrs., TVA, 4204 Kingston Pike, Knoxville, Tenn.

Kemp, Harold Augustus (M. '42), Head Engr., Office, Chf. of Engrs., U.S. Army, Washington, D.C.

Kerr, James Eastham (Assoc. M. '42), Chf. of Survey of Hulls, Western Pipe & Steel Co., South San Francisco (Res., Tracey's Auto Court, Redwood City), Calif.

King, Edwin Vernon (Jun. '42), 2d Lt., Air Corps, U.S. Army, 1219 Forest Ave., Columbus, Ga.

Kirby, Paul Burnard (M. '42), Asst. Chf. Engr., Albert Kahn, Inc., 345 New Center Bldg., Detroit (Res., 1506 Mayfield, Royal Oak), Mich.

Kopf, Herbert Prebble (M. '42), Asst. Engr., City of Rochester, 54 Court St. (Res., 216 Elm Drive), Rochester, N.Y.

Kordish, Emil (Jun. '42), Junior Engr., Eng. and Constr. Div., Aberdeen Proving Ground, Aberdeen, Md.

Krakow, Herbert (Assoc. M. '42), Civ. Engr., Office, Borough Pres. of Manhattan, Municipal Bldg. (Res., 610 Trinity Ave.), New York, N.Y.

Kranichfeld, Henry Charles, Jr. (Jun. '42), Junior Structural Engr., TVA, 715 Union Bldg. (Res., 909 Mountcastle St.), Knoxville, Tenn.

Kuchar, Arthur Morgan (Jun. '42), Junior Naval Archt., U.S.N., Navy Yard (Res., 26 George St.), Charleston, S.C.

Kuntz, Guy Theodore, Jr. (Jun. '42), Timekeeper, National Builders, Box 651, Corvallis (Res., 2133 North East Wasco, Portland), Ore.

Largent, William Henry (Jun. '42), Ensign, U.S.N., 814 North Ewing St., Seymour, Ind.

Laub, David (Jun. '42), Junior Civ. Engr., TVA, 722 Empire Bldg., Syracuse, N.Y.

Laursen, Emmett Morton (Jun. '42), Junior Engr., Al Johnson Constr. Co., 19 Rector St., New York, N.Y. (Res., 2331 Sheridan Ave., North, Minneapolis, Minn.)

Lawton, Carl William (Jun. '42), Instr., Clarkson College of Technology, Potsdam, N.Y.

Lee, John Holmes, Jr. (Jun. '42), Junior Civ. Engr., TVA, Box 365, Gilbertsville, Ky.

Leeper, Robert Fulton (Assoc. M. '42), Associate Engr. (Civ.), U.S. Engr. Office, 520 Merchandise Mart, Chicago, Ill.

Levere, Bernard (Jun. '42), Lt., U.S. Army, 340 Fairmount Ave., Jersey City, N.J.

Ligh, Harry Kuo-Deng (Jun. '42), Junior Engr., War Dept., Aberdeen Proving Ground, 122 Bel Air Ave., West, Aberdeen, Md.

MacDonald, George Ewen (Jun. '42), Transitman, Lockwood, Kessler & Bartlett, Inc., 32 Court St., Brooklyn (Res., 89–19 Two hundred and fortieth St., Bellerose), N.Y.

McCabe, Joseph, Brother, F.S.C. (Jun. '42), Instr., Manhattan College, Spuyten Duyvil Parkway, New York, N.Y.

McCrary, Louis Coleman (Jun. '42), Junior Engr., E. I. du Pont de Nemours & Co., Oklahoma Ordnance Works, Pryor, Okla. (Res., 2306 Schaer Ave., North Little Rock, Ark.)

McCrone, Henry Richmond, Jr. (Jun. '42), 2d Lt., U.S. Army, Knox Marsh Rd., Dover, N.H.

McGuire, Orlo Eugene (M. '42), Designing Engr., Simmons, Hazelet & Erdal, Green River Ordnance Plant (Res., 515 Nachusa Ave.), Dixon, Ill.

McGuire, William (Jun. '42), Ensign, A-V (P), U.S.N.R., 100 Stuyvesant Pl., St. George, Staten Island, N.Y.

McLaughlin, Gurney Edward, Jr. (Jun. '42), Junior Engr., U.S. Engr. Office, Peoples Office Bldg., Charleston, S.C.

Mann, Norman Russell (Jun. '42), Junior Engr., Draftsman, Am. Bridge Co., Elmira Heights (Res., 463 West Church St., Elmira), N.Y.

May, John Robinson (Assoc. M. '42), Engr., Surveys and Plans, Delaware River Joint Toll Bridge Comm., 526 Broad St. Bank Bldg., Trenton, N.J. (Res., 120 East Marshall Ave., Langhorne, Pa.)

Maziarz, Edward Francis (Assoc. M. '42), Constr. Supt., Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.

Medler, Samuel Watson (Assoc. M. '42), Structural Supervisor, Stone & Webster Eng. Corp., Pennsylvania Ordnance Works (Res., 96 Randall Circle, Penn Vale), Williamsport, Pa.

Meeks, Arthur Fred (Jun. '42), Ensign, CEC, U.S.N.R., 1806 Walker Ave., Kansas City, Kans.

Miller, George Erikson (Jun. '42), 2d Lt. Ordnance Dept., U.S. Army, 861st Ordnance Co., Barksdale Field, La. (Res., 850 Parkway Drive, Atlanta, Ga.)

Miller, Lloyd Wendell (Jun. '42), Civ. Engr. (Constr.), M. W. Kellogg Co. (Res., 801 East Lorena), Wood River, Ill.

Miller, William Ellsworth (Jun. '42), Junior Civ. Engr., TVA, 615 Union Bldg. (Res., 1812 White Ave., Apt. 10), Knoxville, Tenn.

Monson, Lyle Edward (Jun. '42), Field Engr., Am. Bridge Co., 208 South La Salle St., Chicago, Ill.

Moore, Thomas Calvin (Jun. '42), Industrial Engr., Rate Dept., Am. Bridge Co. (Res., Graham and Ohio River Blvd.), Sewickley, Pa.

Mulvaney, John Joseph (Jun. '42), Designer, Crandall Dry Dock Engrs., Cambridge (Res., 112 Norton St., Dorchester, Boston), Mass.

Muse, Edward Clayton, Jr. (Jun. '42), 2d Lt., U.S. Army, Headquarters Company, Maintenance Battalion, 8th Armored Div., Fort Knox, Ky.

Noble, Norman Lynn (Jun. '42), Junior Engr., U.S. Engrs., Garden City Air Base (Res., 608 North 3d), Garden City, Kans.

Oddstad, Andrew Fjeldsted, Jr. (Jun. '42), Chf. Engr., Acme Tank Mfg. Co., Inc., 159 South Anderson (Res., 144 South Edgemont), Los Angeles, Calif.

Ohman, Warner (Jun. '42), Structural Draftsman, Am. Bridge Co. (Res., 1021 Maplewood Ave.), Ambridge, Pa.

Oneglia, Francis Joseph (Jun. '42), Junior Constr. Engr., Turner Constr. Co., Broad St., West Lynn, Mass. (Res., 406 New Litchfield St., Torrington, Conn.)

Parker, Jay Bortle (Jun. '42), Ensign, CEC-V(S), U.S.N.R., Naval Constr. Training Center, Norfolk, Va. (Res., Glendale Rd., Latham Heights, N.Y.)

Parker, Thomas McCutchen (Jun. '42), 2d Lt., U.S. Army, Box 408, Sumter, S.C.

Pilling, Alan Henry (Assoc. M. '42), Chf. Engr., Richmond Screw Anchor Co., Inc., 816 Liberty Ave., Brooklyn (Res., 11 Grove Pl., Oceanside), Ill.

Pluciennik, Edmond Richard (Jun. '42), Field Engr., M. W. Kellogg Co., Box 336, Lockport, Ill. (Res., 4734 Ash Ave., Hammond, Ind.)

Press, Emil Asmus Severin (Assoc. M. '42), Asst. to Director, San. Eng., Govt. of Dist. of Columbia, Dist. Bldg., Washington, D.C. (Res., 8420 Queen Anne's Drive, Silver Spring, Md.)

Punshon, Elmer Thomas (Jun. '42), Structural Steel Detailer, Giffels & Vallet, 1000 Marquette Bldg. (Res., 8705 Quincy), Detroit, Mich.

Quillian, Hugarwyn (Jun. '42), Ensign, CEC-V(S), U.S.N.R., Box 68, Daytona Beach, Fla.

Quinn, Joseph Leo, Jr. (M. '42), Acting Director, Div. of Environmental Sanitation, State Board of Health, 1098 West Michigan St., Indianapolis, Ind.

Rabb, James MacMillan, Jr. (Jun. '42), Junior Civ. Engr., TVA, 715 Union Bldg. (Res., 1501 West Clinch Ave.), Knoxville, Tenn.

Rainey, Henry Frederick (Jun. '42), Junior Engr., TVA, Douglas Dam Rural Station, Jefferson City, Tenn.

Robjent, James Frederick (Jun. '42), Junior Engr., Turner Constr. Co., Box 35, Willimantic, Conn. (Res., 62 Elm St., Andover, Mass.)

Rodgers, Theodore Wiechen (Assoc. M. '42), Res. Engr., Div. of Highways, Bridge Dept., State Dept. of Public Works, Box 1499, Sacramento, Calif.

Rutledge, James Norman (Assoc. M. '42), Maj., Air Forces, Eng. Div., U.S. Army, 1701 Sixteenth St., N.W., Apt. 627, Washington, D.C.

Sargent, Walter Howard (Jun. '42), Civ. Engr., Dravo Corp. (Res., 401 West 14th St.), Wilmington, Del.

Schaaf, Earl Henry (Jun. '42), Junior Engr., U.S. Engrs., 505 Federal Bldg. (Res., 310 East College St.), Louisville, Ky.

Schulkers, Joseph Robert (Jun. '42), Junior Naval Archt., P-1, Navy Yard (Res., 1205 Foulkrod St.), Philadelphia, Pa.

Sears, Abram Funk (Assoc. M. '42), Asst. Engr., U.S. Engrs., Clock Tower Bldg., Rock Island, Ill.

Seburn, Thomas James (Assoc. M. '42), City Traffic Engr., City Hall, Kansas City, Mo.

Shalit, Benjamin Barry (Jun. '42), Weight Control Engr., Curtiss-Wright Corp. (Res., 44 North Pearl St.), Buffalo, N.Y.

Shore, Herbert (Jun. '42), Junior Draftsman, The Lummus Co., 420 Lexington Ave., New York (Res., 49 Clarkson Ave., Brooklyn), N.Y.

Simpson, Howard (Jun. '42), Engr., O'Driscoll & Grove, Inc., 247 Park Ave., New York, N.Y. (Res., 614 West 2d St., Seymour, Ind.)

Spector, George (Jun. '42), Junior Engr. (Naval Archt.), Bureau of Ships, U.S.N., 3214 Park Pl., Washington, D.C.

Stahl, Laddie L. (Jun. '42), Lt., Field Artillery, U.S. Army, B.O.C. 62, Fort Sill, Okla.

Stansfield, Donald Hitchen (Jun. '42), Junior Engr. (Structural), Bureau of Yards and Docks, U.S.N., (Res., 4422 New Hampshire Ave., N.W.), Washington, D.C.

Stockebrand, Victor Dale (Jun. '42), With U.S.N.R., 207 West Kansas, Yates Center, Kans.

Storrs, Dean Scott (Jun. '42), 323 Westminster Ave., Salt Lake City, Utah.

Sturgeon, Myron Alfred (M. '42), 502 National Bank Bldg., Suffolk, Va.

Stutzman, Charles Arthur (Jun. '42), Checker, Curtiss-Wright Corp., Plant 2, Genesee St. Cheektowaga (Res., 24 Laverack Ave., Lancaster), N.Y.

Swanson, Carl Gustave Walter (Assoc. M. '42), Associate Prin. Insp., Navy Yard, Brookyn (Res., 3715 Eighty-Third St., Jackson Heights), N.Y.

Sweet, Richard Walter (Jun. '42), Engr., Wing Design Group, Curtiss-Wright Aircraft Corp., Port Columbus (Res., 760 College Ave., Bexley), Ohio.

Telfair, John Spier, Jr. (Jun. '42), Asst. Engr. (Civ.), Corps of Engrs., U.S. Army, U.S. Engr. Office, Jacksonville, Fla.

Terry, John Russell, Jr. (Jun. '42), Route 1, Fountain Inn, S.C.

Thoman, John Richard (Jun. '42), San. Engr., Chicago Pump Co., 2336 Wolfram St., Chicago, Ill. (Res., 741 Bulen Ave., Columbus, Ohio.)

Tobey, Frank Thrall, Jr. (Jun. '42), Engr., Lee Constr. Co., Lamar Ave. (Res., 41 North Bellevue, Apt. 56), Memphis, Tenn.

Trostle, Nevin Elmer (Assoc. M. '42), Water Supt. and City Engr. (Res., 1314 South 21st St.), Temple, Tex.

Trotland, Donald Walter (Jun. '42), Engr. Draftsman, Douglas Aircraft Co., 3000 Ocean Park Blvd., Santa Monica (Res., 153½ Camden Ave., West Los Angeles), Calif.

Waller, Eric Wenborne (Jun. '42), Field and Constr. Engr., Jones & Laughlin Ore Co., Benson Mines (Res., 214 East Filbert St., East Rochester), N.Y.

Wang, Chu-Kia (Jun. '42), 802 West Illinois St., Urbana, Ill.

Wang, Hanley Arthur (Assoc. M. '42), Structural Engr., U.S. Engr. Dept., 751 South Figueroa St., Room 360 (Res., 4113 York Blvd.), Los Angeles, Calif.

Warren, Donald Clifton (Jun. '42), 2d Lt., U.S. Army, 313 South York St., Elmhurst, Ill.

Wasil, Benjamin Abraham (Jun. '42), Junior Engr., TVA, 510 Pound Bldg. (Res., 518 Pine St.), Chattanooga, Tenn.

Weber, Emil August (M. '42), Pres., McMullen & Pitz Const. Co., 923 Commercial St., Manitowoc, Wis.

Weber, Murray (Jun. '42), Junior Civ. Engr., TVA, Fort Loudoun Dam (Res., 207 A St.), Lenoir City, Tenn.

Wesp, Edward, Jr. (Jun. '42), Eng. Asst., Am. Gas & Elec. Service Corp., 30 Church St. (Res., 2100 East Tremont Ave., Apt. 7-D), New York, N.Y.

White, Floyd Eric (Jun. '42), With Am. Bridge Co., Elmira Heights (Res., Y.M.C.A., Elmira), N.Y.

White, Lewis Homer (Jun. '42), Time Study Engr., Am. Bridge Co., Ambridge (Res., Graham and Ohio River Blvd., Sewickley), Pa.

Williams, Bennett Good (Jun. '42), Junior Engr., U.S. Engr. Dept., Penn Mutual Bldg., Philadelphia, Pa. (Res., 515 Delaware St., New Castle, Del.)

Williams, Nolan Harold (Jun. '42), Draftsman (Conveyor Designer), Giffels & Vallet, Inc., 1000 Marquette Bldg. (Res., 3044 Blaine St.), Detroit, Mich.

Williams, Robert Angus (Jun. '42), Structural Draftsman, Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh (Res., 621 Broad St., Sewickley), Pa.

Williams, Samuel Wesley, Jr. (Jun. '42), Junior Engr., Turner Constr. Co., Southington, Conn.

Winterberg, Samuel Jay (M. '42), Chf. Engr., Fehlhaber Pile Co., Inc., 205 East 42d St., New York, N.Y.

Wright, John Martin (Jun. '42), 2d Lt., U.S. Army, 646th Tank Destroyer Battalion, Fort Huachuca, Ariz.

Wright, William Richard (Jun. '42), Junior Structural Draftsman, Am. Bridge Co. (Res., 334 Glenwood), Ambridge, Pa.

Ziegelmeier, Milton Allen (Jun. '42), With Am. Bridge Co. (Res., 430 Ellsworth St.), Gary, Ind.

MEMBERSHIP TRANSFERS

Andrews, Earle Topley (Assoc. M. '32; M. '42), Gen. Supt., Pennsylvania Glass Sand Corp., Mapleton Depot, Pa.

Barnes, Bertram Soules (Assoc. M. '37; M. '42), Regional Engr., U.S. Weather Bureau (Res., 175 Twenty-sixth Ave.), San Francisco, Calif.

Brockway, George Samuel (Assoc. M. '36; M. '42), Civ. Engr., 407 Guaranty Bldg., West Palm Beach, Fla.

Buck, Roy McGarvey (Assoc. M. '34; M. '42), Capt., Corps of Engrs., U.S. Army, Post Engr., Gardner Field, Taft, Calif.

Burke, Robert Wayland (Jun. '39; Assoc.M., '42), Capt., Corps of Engrs., U.S. Army, Engr., Maintenance Officer, Columbus General Depot, Columbus, Ohio.

Castleman, Francis Lee, Jr. (Jun. '26; Assoc. M. '31; M. '42), Prof. and Head, Dept. of Civ. Eng., Univ. of Connecticut, Storrs, Conn.

Crowley, John Bernard (Jun. '35; Assoc. M. '42), Structural Designer, Gibbs & Hill, Inc., Pennsylvania Station (Res., 536 West 152d St.), New York, N.Y.

Davis, John Swift (Jun. '31; Assoc. M. '42), Asst. Area Engr., Air Support Command Base, Box E, Pollock, La.

Dean, William Ennels, Jr. (Jun. '31; Assoc. M. '42), Asst. Bridge Engr., State Road Dept., Martin Bldg. (Res., 821 East 7th Ave.), Tallahassee, Fla.

Dees, Ben Woodall (Jun. '34; Assoc. M. '42), Associate Engr., Marion L. Crist & Associates, Union Life Bldg. (Res., 604 South Oak St.), Little Rock, Ark.

Estrin, Fred (Jun. '33; Assoc. M. '42), Chf. Engr., M. Hoffman Contr. Co., 309 Victor Bldg. (Res., 5400 Olive St.), Kansas City, Mo.

Fetters, Howard Frederick (Jun. '36; Assoc. M. '42), 702 West Washington St., Winchester, Ind.

Harroun, Dale Theran (Jun. '32; Assoc. M. '42), Associate Structural Engr., Public Works Design Office, Naval Operating Base, Norfolk (Res., 1359 Roanoke Ave., Newport News), Va.

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Huey, Stanton Ennes (Assoc. M. '30; M. '42), Cons. Engr. (Huey & Cage), 515 Quachita Bank Bldg., Monroe, La.

Kline, Carroll Nathan Raver (Assoc. M. '36; M. '42), Asst. Chf. Engr. (Chf. Design Engr.), J. G. White Eng. Corp., Lake Ontario Ordnance Works, Lewiston (Res., 1311 Garrett Ave., Niagara Falls), N.Y.

Klyce, Erskine Watkins (Jun. '35; Assoc. M. '42), Res. Engr., Roberts & Schaeffer Co., 307 North Michigan Ave., Chicago, Ill. (Res., 1916 Emerson Ave., Dayton, Ohio.)

Mastriani, Samuel Gabriel (Jun. '26; Assoc. M. '35; M. '42), Lt., CEC, U.S.N.R., Navy UUE, Care, Postmaster, San Francisco, Calif. (Res., 1524 Adams Ave., Dunmore, Pa.)

Millen, Vincent Laddie (Jun. '36; Assoc. M. '41), Lt., U.S. Army, Box 315, Jacksonville, Fla.

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Runyan, Damon Ogden (Jun. '38; Assoc. M. '42), Architectural Engr., G. Meredith Musick, Denver, Colo. (Res., 1027 State Ave., Kansas City, Kans.)

Schweser, Gilbert Constant (Jun. '37; Assoc. M. '42), Asst. Engr., Giffels & Vallet, Nebraska Ordnance Plant, Wahoo (Res., 250 West 9th St., Fremont), Nebr.

Shanley, Edmund Michael (Jun. '38; Assoc. M. '42), Lt., CEC, U.S.N.R., Navy Yard, Brooklyn, N.Y.

Spalding, Prescott Oulton (Jun. '38; Assoc. M. '42), Constr. Engr., Ellis C. Snodgrass, Navy Pier, Portland (Res., 37 Bellevue Ave., South Portland), Ore.

Steinbach, Charles William (Jun. '31; Assoc. M. '42), Lt. (jg), CEC, U.S.N.R., 71 Chestnut St., Lewistown, Pa.

Todd, Clarence Lionel (Assoc. M. '13; M. '42), Dept. Mgr., Pittsburgh-Des Moines Steel Co., Neville Island Station (Res., 243 Parker Drive, Mount Lebanon), Pittsburgh, Pa.

Turney, John Garrett (Assoc. M. '34; M. '42), Director of Public Works, 900 Brazos (Res., 2817 Southmore Blvd.), Houston, Tex.

Will, Walter George (Assoc. M. '20; M. '42), Comdr., U.S. Coast Guard, 9th Naval Dist., 1700 Keith Bldg., Cleveland, Ohio.

Winter, Hugo Herman (Assoc. M. '24; M. '42), Engr., Rapid Transit Design, Bureau of Eng., City of Los Angeles, Room 555, City Hall, Los Angeles, Calif.

REINSTATEMENTS

Bennett, Paul Denney, Jun., reinstated Sept. 28, 1942.

Bertrand, John Baptist, Assoc. M., reinstated Sept. 14, 1942.

Blue, Walter Anthony, Assoc. M., reinstated Sept. 21, 1942.

Carlsen, Christian Elmer, Jun., reinstated Sept. 24, 1942.

Collisson, Norman Harvey, Assoc. M., reinstated Sept. 29, 1942.

Fleming, Eric, M., reinstated Sept. 15, 1942

Gibson, Olen Clay, Jr., Jun., reinstated Sept. 28, 1942.

Heaman, William McPherson, Jun., reinstated Sept. 29, 1942.

Hemmings, Harry Howard, Assoc. M., reinstated Sept. 16, 1942.

Hull, George Beckley, M., reinstated Oct. 9, 1942.

Hull, William Deloney, M., reinstated Sept. 30, 1942.

Johnson, Chester Herman, Jun., reinstated Sept. 25, 1942.

Lemonds, Donald Arthur, Jun., reinstated October 5, 1942.

Lyman, Melville Henry, Jr., Jun., reinstated Sept. 22, 1942.

MacMurray, Lloyd Charles, Jun., reinstated Sept. 17, 1942.

McCluskey, William Oliver, III, Jun., reinstated Sept. 24, 1942.